NEW YORK SEATTLE

MOTORSHIP

Devoted to Marine Oil Engine and Motor Vessels

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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

(Trade Mark Registered)

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

Vol. VIII New York, U. S. A., March, 1923 No. 3

(Cable Address—Freemote, New York)

A typical power-driven canal boat of former days with its attendant barges. This fleet has a maximum capacity of only 300 tons compared with 2,000 tons for a fleet of modern barges built along similar lines, but not much larger

Economical Transportation on New York State Canal

CONSIDERABLE activity in the way of plans for new motor vessels and oil-engined tugs on the New York State Barge Canal seems to be in the air, and undoubtedly some of them will mature. It will be remembered that in December last the Standard Transportation Co. of New York ordered twin 300 shaft h.p. McIntosh & Seymour Diesel engines for an 1,800 tons d.w.c. canal tanker, to be built at the Sun Shipyard, Chester, Pa., and may order a duplicate motorship, while the McDougal interests ordered four 375 shaft h.p. Lombard Diesel engines for two electrically propelled canal freighters to be built at the Great Lakes Engineering Works, Detroit, Mich., and three other recent orders outlined at the end of this article, so that at last some definite work is in progress for the annual opening of this magnificent waterway next Spring.

A most thorough series of articles on all phases of transportation on this great inland waterway were published in MOTORSHIP for March, April, June and July, 1921, following an exhaustive investigation by MOTORSHIP's special commissioner, who is now studying Diesel engine construction in Germany in a personal way. The following remarks are intended to supplement the discussions on the subject of canal transportation previously published.

What is undoubtedly the most surprising

Results of Experimental Operation—The Use of Oil Engine Power—Facts Relating to Floating Equipment on the World's Greatest Inland Waterway

By GORDON P. GLEASON

feature in the development of the barge canal system, is the absolute lack of concurrence among barge operators as to the proper type of carrier to be adopted. This difference of opinion has lead to the design of numerous types of barges and, while no single type has met with unqualified approval, it is generally accepted that for general freight carrying the large boat has no place on the new canal and that the greatest economy and efficiency can be rendered by several smaller boats operating as a fleet. Despite this, those interested in the design and operation of canal craft are as far apart as they were prior to the opening of the waterway and one still finds naval architects planning the construction of barges which will utilize the full channel and lock dimensions, regardless of the fact that two years' operation of such vessels has demonstrated their many disadvantages.

Judging from the floating equipment seen on the canal from time to time, many boat designers have apparently forgotten that the Barge Canal is what its name indicates—a waterway for barges. It would also appear that they have neglected to take into account the fact that this channel, like all other waterways of a similar nature, is subject to certain natural conditions which cause a fluctuation in the depth and width of the canal prism. The new canal has been constructed with certain controlling features. Its locks all have usable, inside chamber dimensions of 310 by 44½ feet with a 12 foot depth of water over the miter sills. The channel itself has various dimensions, the controlling one being the land line or artificial section where the prism has a minimum bottom width of 75 feet and a minimum depth of 12 feet. These figures show that, in order for two loaded barges to meet and pass at speed, their width should be somewhat less than one-half of 75 feet, while the locks restrict the length of such carriers to not over 300 feet.

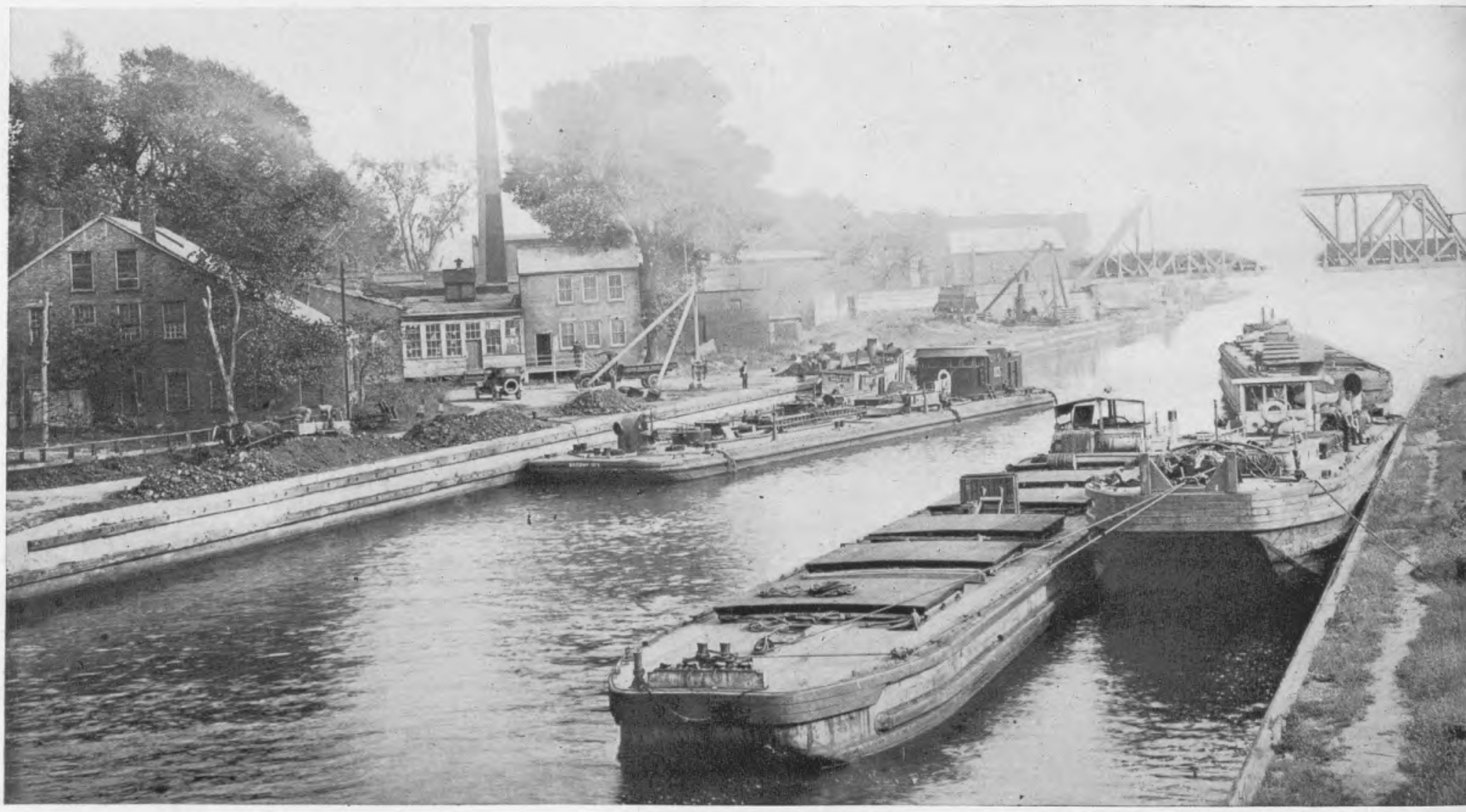
The matter does not end here for there are other controlling and economic considerations that must be taken into account. First, the operator must consider the fact that his craft will have to navigate several curves and tangents while en route to the seaboard from the Great Lakes. This would serve to warn against the long barge as, no matter how cautiously such a carrier

is operated, its stern has a decided tendency to swing toward the embankment. The second consideration has to do with the draught and capacity of the carrier itself.

While the canal is designed and has been constructed with a minimum depth of 12 feet, this depth is not always available owing to the vast amount of material that is washed into the channel during the spring and winter flood periods. This cannot be avoided as the canal is, for the greater part of its length, a canalization of existing rivers and lakes. These are fed by numerous streams and each spring, the melting snow and ice converts these, otherwise placid brooks, into raging torrents, which sweeping down from the hills and mountains adjacent to the canal, wash considerable sand, gravel and boulders into the navigable channel.

To overcome this the State authorities keep careful watch over the canal system channel which are more liable to be filled in during the flood period than are others. These locations have been carefully watched for the past five years and the State Engineer is of the opinion that if the State maintenance forces dredged these sections each fall to a depth ranging from fourteen to sixteen feet, it would provide pockets for the collection of the material washed into the channel and still give the canal a navigable depth of 12 feet on the opening of navigation each spring.

There is still another item that must be considered and that is the fact that there should be a certain ratio between the width of a boat and its waterway and this should not be materially exceeded if resistance to movement is to be reduced to a minimum. This ratio may be taken, on the average, as 1 to 6, thus with a waterway 139 feet wide, which is about the surface width of the land line sections of the Barge Canal, a vessel steel and concrete barges for the canal. These were all 150 by 21 feet, each fleet consisting of three consort barges and one towing and cargo carrying barge. The consort barges, being entirely devoted to the movement of freight have a capacity of 650 tons each for the steel barge and 550 tons each for the concrete carrier provided the boat is loaded to a draught of 10 feet. The propelling unit, being designed to tow three consorts has a much lower freight carrying capacity, the cargo tonnage of such a barge being between 350 and 450 tons. This gives a maximum fleet capacity of between 2,000 and 2,400 tons for each fleet. The only mistakes made in the design of these boats, which have been sold and are being operated by a private corporation, was that they followed a design prepared for barges used on the Mississippi and Warrior rivers. The boats are a little too heavy for successful operation at lock approaches



Fleet of modern steel barges passing a S. O. motor-tanker in lock approach on the New York State canal. The very low free-board of the tanker would seriously interfere with loading operations at terminals were the cargo carried general-freight instead of bulk-oil

at all times and as soon as conditions warrant, the maintenance forces sweep the channel, locate obstructions and send dredges to work removing the material. As a result, it has been found that from early April until the middle of July, the channel does not have its full minimum dimensions in certain places. The dredges, it is true, make a channel 12 feet deep but the canal is opened to navigation before this work is completed and for several weeks there are certain stretches where only a 10 foot depth can be safely figured on. This means that barges, if they are to be operated with security at such periods, must be loaded to a draught of not over 8 feet, although later on, when the full depth of 12 feet is available, the normal operating draught is increased to from 10 to 10½ feet.

A new plan, calculated to remedy canal conditions, has been prepared by State Engineer and Surveyor Dwight B. LaDu. Mr. LaDu has collected data which clearly show that there are certain sections of the should be approximately 20 to 22 feet wide. The locks being 44½ feet in width it is seen that two boats with a beam of 21 feet each can be placed side by side in the chamber. The proper length for such a width is 150 feet and the locks being 310 feet long and 44½ feet wide it is seen that they will accommodate a fleet of four barges each 150 by 21 feet and these, if operated on a draught of 10 feet and having 12 foot sides should have a cargo capacity of between 550 and 650 tons each. The 10 or 10½ foot draught on a channel 12 feet deep is insisted upon owing to the necessity of having a water cushion between the bottom of the canal prism and the keel of the boat. If this water cushion is 2 feet, it will be found that it is much easier to operate the vessel and that a much better rate of speed can be maintained.

Acting on the assumption that a fleet of barges is more efficient than a single carrier of greater dimensions, the Federal Government, in 1918, constructed a number of while the moulded stern, although ideal on the Mississippi River, has a tendency to impede the progress of the vessel in the more restricted sections of the Barge Canal.

A large oil company, which has seriously taken up the waterway as a transportation route, has placed several tank barges on the canal and operates these as independent units, disregarding the fleet theory. Five of these vessels are consorts, that is, barges designed for the movement of freight and not provided with their own propelling equipment. These have various dimensions, the most successful tanker used being one 140 feet long, 30 feet wide and having a cargo capacity of 640 tons on a draught of 10 feet. This is a tank barge, however, and naval architects agree that it would not be practical as a general cargo carrier, owing to its excessive beam which would preclude the operation of more than two barges at one time and the fact that the boat has to be towed by an accompanying tug. This same company also has a fleet of self-pro-

Skandia oil-engined canal motorship at Albany barge canal terminal

pelled tankers on the canal. Each of these carriers is 155 feet 6 inches long, 28 feet 6 inches beam and has 12 foot sides, with a cargo capacity of 465 long tons on a draught of 10 feet. These barges are equipped with gasoline burning internal-combustion engines, and maintains a speed of 6 miles in the land line sections of the canal and 10 miles per hour in the canalized river sections. The self-propelled tankers are ideal for their purpose, which is carrying oil, but officials agree that their operating cost plus their low carrying capacity, makes them anything but economical as carriers of general cargoes. Ordinary commercial companies to whom cheap gasoline is not available could not run such craft in competition with heavy-oil engined craft. This is further illustrated by the fact that, after two years operation of these barges, their owners have determined to reconstruct them, providing for the installation of Diesel engines.

"Transco II," one of three Nelseco-Diesel-powered tugs on New York canal

Fleet of Transmarine barges in lock. These are towed by Nelseco-Diesel-powered tugs

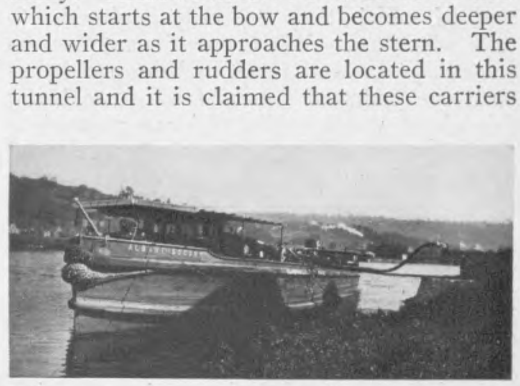
The most successful types of barges constructed to date have been wooden carriers which follow the design and lines of the old type canal boat. These old carriers were really floating boxes in that their stern and bow were almost square and every bit of available hold space was devoted to cargo carrying purposes. The new barges of this type, however, are much larger than the old canal boat and are designed for operation in fleets of four, the propelling unit of the fleet being a tugboat. The latter should be Diesel driven. The most approved dimensions for these barges are: length 130 feet, beam 20 feet, sides 12 feet, cargo capacity 500 long tons on a draught of 10 feet. This allows plenty of room in the lock chamber for a good sized tug and gives a fleet capacity of 2,000 long tons. The advantage of these barges consists of the fact that they can be efficiently operated in restricted channel sections by being strung out or can be grouped together in lock chambers or in river and lake sections. The only trouble encountered in operating these boats is found in crossing Lake Oneida on the Erie Branch of the canal system. This is a lake 20 miles long, unprotected by hills and is subject to occasional storms which seriously interfere with the operation of a tow of canal barges of any type.

Early in 1922 the first of a fleet of five steel motorships were placed on the canal system by Julius Barnes interests. Each of these barges was 256 feet long, 36 feet beam and had 14 foot sides, being designed for operation on the Great Lakes as well as the Barge Canal, the intention being to provide a carrier which would eliminate a transfer of freight at the Port of Buffalo on Lake Erie. Each boat was equipped with two surface-ignition type oil-burning engines and was designed for operation at a maintained speed of 8 miles per hour. The first trial trip of each motorship was made from Duluth to Buffalo and thence to New York via the Barge Canal. While on the lakes, the vessels operated at a draught of 12 feet leaving a 2 foot freeboard which necessitated their taking the inshore route. At Buffalo part of the cargo was removed, the vessels being reduced to a draught of 10 feet leaving a 4 foot freeboard. The operation of the motorships on the lakes, insofar as it meant a comfortable voyage and ideal navigation facilities, was successful, but it was found impossible to compete with lake carriers owing to the fact that these monster vessels move from 12,000 to 14,000 or more cargo tons while the motorships could move only 2,000 tons. Furthermore, the fact that the motorships had to discharge part of their cargo at Buffalo, in order to reduce their draught for operation over the Barge Canal was an additional expense which could not be faced with any assurance of financial success. This was even further reduced owing to the fact that, during the maintenance period the motorships, designed for operation on a 12-foot draught, were forced to reduce this to 8 feet, which meant operating with something less than 1,200 cargo tons in their hold although they had been designed to move 2,000 cargo tons.

The operation of the motorships was the first attempt made to utilize the large barge on the waterway and, from both a financial and operation standpoint it was not a success not because of the type of power, but because of the size and type of hull. The barge, in navigating channel curves, was forced to reduce speed, with the result that the stern showed a decided tendency to swing into the embankment. The rudders were changed, but even this did not solve the problem and it was found necessary to have tugs assist in the navigation of the barge, at certain periods of the season. The sum and substance of the motorship experiment is that it clearly demonstrated that the object naval architects, designing canal craft, should have in mind if they seek to eliminate an exchange of freight at Buffalo, is that of adapting canal barges to lake use rather than adapting lake vessels to canal purposes.

The adherents of the smaller barge, to be operated in fleets, seem to have clearly proven their point. Since 1918 it has been repeatedly demonstrated that the fleet is capable of much more efficient operation than either the large barge or the smaller self-propelled barge operated as an independent unit. This is due to several factors. First: if the operator has a fleet of four barges, one of which is only partially loaded, he can proceed with his fleet to one of the terminal points on the canal, cast off the partially loaded carrier, take on a fully loaded one and proceed to his destination without delay and the loss of money such a delay entails. Second: the fleet has the advantage of being elastic, that is, it may either be strung out in single line, grouped or even split up as occasion might require. Third: it is possible to reduce the draught of the smaller barge and still allow for the movement of more cargo than can be carried in the large barge even when it is loaded to its full draught of 10 feet.

Recently, the tunnel-hull, self-propelled motor barge has attracted the attention of many. These boats have a tunnel in the hull which starts at the bow and becomes deeper and wider as it approaches the stern. The propellers and rudders are located in this tunnel and it is claimed that these carriers



Standard Oil Company's tank barge "Albany Socony" pumping cargo at Little Falls, N. Y. She is propelled by 300 b.h.p. Standard gasoline engine. Her two cargo pumps are each driven by a 50 b.h.p. direct-connected Standard gasoline engine

can maintain a high rate of speed in the most restricted portions of the canal while, owing to the tunnelled hull, the boat has a greater buoyancy and can move a much greater tonnage on a lighter draught than any barge as yet designed for or used on the canal.

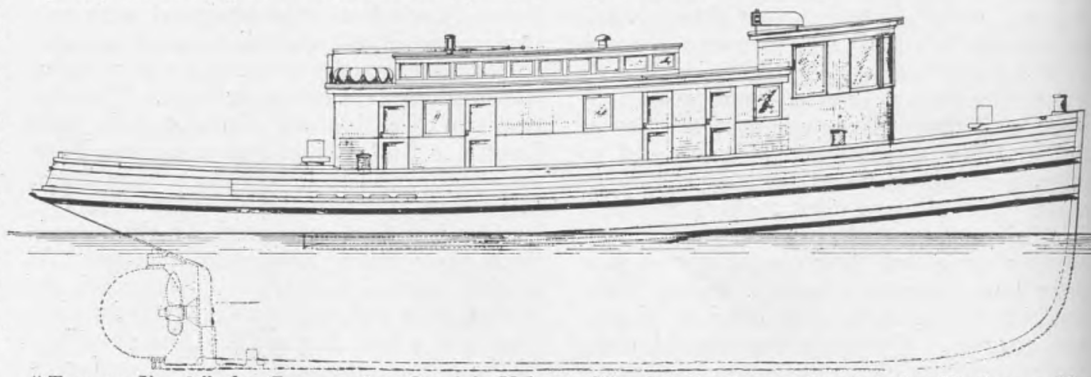
At least two types of tunnel hull barges have been designed, one being provided with a Diesel electric propelling equipment and the other with internal-combustion engines adapted to burning kerosene oil. The designs have been tried out in model form and while considerable secrecy shrouds their specifications, they have, it is said, met all official Government tests and are declared to be as efficient as their designers claim them to be.

One of the companies interested in tunnelled hull barges, expects to place one of these on the canal next year and announces that its boat will be 200 feet long, 25 feet beam and will move a total of between 1,800 and 2,000 cargo tons on a draught of 8 feet. They assert that pontoon rudders will overcome the tendency of the carrier to swing toward the embankment at channel curves and that the boat will, owing to the fact that the tunnelled hull tends to eliminate wash, be able to maintain a speed of 10 miles per hour in the narrow land line sections and from 12 to 14 miles per hour in canalized river sections.

If this is so, and if heavy-oil motors are adopted, the canal carrier problem, insofar, as it relates to the Barge Canal, will be solved. At present, however, the most efficient and economical canal barge is the wooden carrier, following the design of the old type canal boat and operated in fleets of four, the fleet having a capacity of 2,000 cargo tons as against a capacity of 800 cargo tons for the old canal boats.

It is well to mention at this time that two additional Nelseco Diesel-driven tugs have been ordered for the Canal traffic by the Transmarine Corporation. This company operates thirty modern steel barges of about 450 tons capacity especially adapted to the carrying of package freight in bulk cargoes as well as structural steel and steel rails up to 7 ft. in length. At present they have three Nelseco Diesel-driven tugs in service which have already been described in the pages of MOTORSHIP. These tugs tow five barges and have constantly maintained their schedule of from seven to nine days between New York and Buffalo. Fleets have made the round trip from New York to Buffalo, discharging cargo, reloading, and back to New York in 14½ days. In June, 1922, over 3,000,000 bushels of grain from the Lake region were transported in the Transmarine Company's barges to the tidewater for transportation to Europe and not a single bushel was damaged.

The Ore Steamship Corp. of New York have issued plans for an 84-ft. tug for barge towing and a 240 b.h.p. Nelseco-Diesel engine will be installed.



"Transco No. 1," the Transmarine Corp'n's Nelseco Diesel-engined tug, showing the Kitchen rudder

CURRENT REVIEWS

New York Waterways Advocate. — Monthly magazine published by the Syracuse Printing and Publishing Co., Syracuse, N. Y., January, 1923. Inland waterway transportation has a "live" and interesting champion in this monthly publication, copies of which we have read with interest. For anyone desiring to keep well in touch with developments on the New York State Barge Canal we could not recommend a better medium.

History of the Barge Canal.—By Senior Ass't Engineer N. E. Whitford, State Engineer's Dept., Albany, N. Y. Published under authority of Frank M. Williams, ex-State Engineer, 1922. We have read with keenest interest this most complete history of the steps which were taken to first obtain the necessary sentiment for the construction of the New York State Barge Canal, of the fight which its advocates made and won in the New York State Legislature, of the men and the equipment which accomplished this truly great task and of the wonderful facilities right at the very doors of shippers and of which they are only beginning to take advantage. When one views the present equipment and facilities he can only regard the years of constant effort to bring this about worth while and can appreciate the effort as so comprehensively reviewed by the author.

Primer of the Internal-Combustion Engine.—By H. E. Wimperis. Published by D. Van Nostrand Co., New York, 1910, 144 pages. Price $1.50. While this little book contains very little material on oil-engines it is a condensed treatise on thermodynamics and the theory of the internal combustion engine and is intended as a primer for those studying the subject for the first time. As an introduction to the author's larger work, "The Internal Combustion Engine," it is less voluminous, but as the text is worded the same as in the larger work the latter is much to be preferred even for the notice on this type of engine.

The Internal-Combustion Engine.—By H. E. Wimperis. Published by D. Van Nostrand Co., New York, 1919. 320 pages. Price $3.00. As a text book on heat engines which operate on the internal combustion principle this book covers the ground well, dealing with thermodynamics and cycles, combustion and explosion, gas engines, gas producers, gases, and a chapter on oil-engines. A number of examples with answers for each subject are included.

A New Oil Engine.—By A. F. Van Amstel. Brochure published Jan., 1923, by A. F. Van Amstel, Amersfoort, Holland. 20 pages. Price 50 cents. The author prepared this well-printed and attractively illustrated brochure for the purpose of exploiting his design of oil-engine, which is patented in most countries, among manufacturers for business reasons. He is also selling copies. The system of fuel-injection described is one of airless-injection on the author's patents, involving two separate agents, one for spraying the fuel into the cylinder, the other for mixing the charge and creating turbulence. Increasing combustion pressure is produced and it is claimed that an engine built on this design is lighter, requires less space and of greater fuel economy than the Diesel-engine.

The Diesel Engine.—By A. Orton. Published by Sir Isaac Pitman & Sons, Ltd., London, 1923. One of Pitman's Technical Primers. 108 pages. Price 85 cents. This little book of pocket size is one of the best we have read on the Diesel-engine, as it is written in simple language which students or mechanics can understand, it is clearly illustrated and as a primer is ideal.

A Handbook on Piping.—By Carl L. Svensen. Published by D. Van Nostrand Co., 1922. 360 pages. Price $4.00. We thoroughly believe that this book on piping, pipe fittings, and layouts will meet with a splendid reception, for it contains a wealth of information on these subjects and fills a place in technical literature which has been somewhat neglected. Prof. Svensen's book supplies in convenient form complete data, some strictly for use in connection with work on shore, but there is much which concerns piping on shipboard.

Elementary Internal-Combustion Engines,—By J. W. Kershaw. Published by Longmans, Green & Co., London, 1922. 211 pages. Price $1.75. This book is principally on the subject of internal combustion engines in general, gas-producers, ignition, indicator diagrams, calorific power, etc., but contains two or three chapters on oil-engines in particular. The book is of handy pocket size and includes an appendix of problems with answers.

IMPORTATION OF SHIP MATERIALS INTO ITALY

The Institution of Italian Naval Architects and Engineers has passed a vote recommending the admission of all materials and accessories required for shipbuilding into Italy free of Customs duty. Official adoption has been announced. Orders for advertising in the *La Marina Italiana,* the most important shipbuilding and shipping magazine in Italy, can be placed through the offices of MOTORSHIP, 27 Pearl St., New York City. Rates will be quoted upon application.

An intermediate type high-speed oil-engine of 1,600 b.h.p. is now being constructed for the British Air Ministry. It is said to be as light as gasolene engines.

Large Motorship and Oil-Engine Progress in America to Date

Record Amount of Diesel Work Now on Hand Despite Steamship Building Slump—Splendid Opportunity for Equipment Manufacturers to Secure Business—The Growth in Seven Years

FEW people realise that including war-time wooden motorships and auxiliaries there have been built or now under construction and conversion in America approximately half a million deadweight tons of motorships of 1,000 tons and over, and that to-day there is more large Diesel work in prospect (with more in prospect) than ever before despite the country being in the midst of the worst steamship building slump she has ever faced. As will be seen by the table the new power aggregates 50,850 shaft horsepower. Then there are hundreds of oil-engined commercial craft of 35 to 500 b. h. p. under construction or recently placed in service, of which it is not feasible to give a list at this time, so in the following tables we have confined ourselves to large engines and vessels of 1,000 deadweight tons or of 1,000 gross tons, as the case may be, and over. All these engines and vessels mean considerable orders for marine equipment manufacturers, such as winches, steering-gears, anchors, anchor-chains, capstans, paint, varnish, gratings, rope, rivets, piston-rings, valves, gauges, silencers, wireless, electric motors, generators, fuel-oil heaters, oil-filters, lubricating-oil coolers, air-compressors, lighting-sets, thrust-bearings, auxiliary oil-engines, donkey-boilers, tanks, toilet-fixtures, navigating-instruments, davits, row-boats, motor life-boats, life-rafts, fire-extinguishers, devices and systems, asbestos lagging, packing, etc., and replacements later on.

To afford a comprehensive idea of the growth and progress of the oil-engined merchant vessel during the seven year period that MOTORSHIP has been published we will first give a list of vessels of 1,000 gross tons and over, in service. This list omits at least 100,000 tons of large wooden full-powered motorships and auxiliaries built during the War and passed to foreign ownership or lost at sea, nearly a dozen having been destroyed by fire. But, the lists without these show that the oil-engined motorship industry has become one of considerable importance in this country. In fact it is the salvation of ship and engine builders and marine equipment manufacturers who can no longer look to new steamship construction to be kept busy, although there are, of course, a certain number of orders on hand in the yards.

AMERICAN FULL-POWERED MOTORSHIPS OF 1,000 GROSS TONS AND OVER IN SERVICE

Name of Vessel	*Make of Diesel*	*Gross Tonnage*
BABINDA	McIntosh & Seymour	3,098
BACOI	McIntosh & Seymour	1,696
BAYONNE	McIntosh & Seymour	1,077
BENOWA	McIntosh & Seymour	3,093
BOOBYALLA	McIntosh & Seymour	3,099
BRAMELL POINT	McIntosh & Seymour	3,262
CALIFORNIA	Cramp—B. & W.	7,899
CETHANA	McIntosh & Seymour	2,341
CHALLAMBA	McIntosh & Seymour	2,400
CHARLIE WATSON	Pacific-Werkspoor	1,769
COOLCHA	McIntosh & Seymour	2,403
CUBORE	Bethlehem—West	6,891
CULBURRA	McIntosh & Seymour	2,353
DONNA LANE	McIntosh & Seymour	2,185
DORIA	Craig	1,420
EDITH NUTE	Nelseco	1,000
FORDONIAN	Ansaldo-San Georgio	2,367
FULTON	Nelseco	1,000
GLENDARUEL	McIntosh & Seymour	2,063
H. T. HARPER	Pacific-Werkspoor	3,803
HOLDEN EVANS	Bolinder	3,253
J. F. PENROSE	McIntosh & Seymour	3,379
JAMES TIMPSON	Winton	2,016
KENNECOTT	McIntosh & Seymour	3,620
LA MERCED	Winton	1,696
LIBBY MAINE	Dow	1,811
MARYLAND	McIntosh & Seymour	2,498
MISSOURIAN	Cramp—B. & W.	7,899
MOUNT BAKER	Winton	2,904
MURIEL	Skandia	2,220
MAZATLAN	Winton	1,500
MAUMEE	Nurnberg	8,000
ORMIDALE	McIntosh & Seymour	2,063
PENNANT	Bolinder	3,253
PINTHIS	Bolinder	1,111
SANTA FLAVIA	Bolinder	2,113
SIERRA	Bolinder	1,034
SOLITAIRE	McIntosh & Seymour	3,350
TANCARVILLE	Bolinder	2,447
TROLLTIND	Winton	2,174
WILLIAM PENN	Burmeister & Wain	7,615

Total..........40 ships, 121,175 gross-tons (193,500 ton d.wc.)

Several American built motorships have been sold to foreign buyers, so are not included in this list.

AMERICAN AUXILIARY MOTOR-VESSELS OF 1,000 GROSS TONS AND OVER IN SERVICE

Name of Vessel	*Make of Oil-Engine*	*Gross Tonnage*
ADMIRAL MAYO	Skandia	1,934
ANNIE JOHNSON	Bolinder	1,028
ASTA	Bolinder	1,965
ASTORIA	Skandia	1,611
CHARLES S. GAWTHROP	Winton	1,488
DAWNLITE	Bolinder	1,976
DAYLITE	Bolinder	1,976
MANTOVA	Bolinder	2,422
MOONLITE	Bolinder	1,955
OREGON	Southwark-Harris	1,616
ORONITE	Bolinder	1,704
SHEREWOG	Winton	1,353
STANDTOW No. 1*	Bolinder	1,955
SUNLITE	Bolinder	1,976
W. F. BURROWS	Skandia	1,560

Total..........15 ships, 26,519 gross-tons (41,500 tons d.wc.)

Several large auxiliaries have been lost at sea and are not included in this list, nor are those that have been sold to foreign buyers of which there are at least 20 propelled by Fairbanks-Morse, Atlas-Imperial, Sumner, Craig, Bolinder, and Winton oil-engines.

In addition to the above list there are two 1,700 shaft h.p. McIntosh & Seymour Diesel-engines ready for installation, as well as one Worthington Diesel-engine of 1,850 shaft h.p.; also there is one 2,200 shaft h.p. Diesel set now running tests at a plant in the Middle West, making a grand engine total of 50,850 shaft horsepower, aside from hundreds of smaller marine oil-engines. Hulls will soon be found for these four additional engines. With the exception of the three Sun-Doxford two-cycle opposed-piston engines, all are of the four-cycle type. The hulls for the Moore & Sun Shipbuilding companies have not actually been purchased, but negotiations with the Shipping Board are being completed.

If the Subsidy Bill is passed the Munson Line and other shipowners will convert a number of steamers to Diesel power, and twelve 8,800 tons steamers will be converted to Diesel engines by the Motorship Service Corporation of San Francisco for which Diesel engines will have to be ordered. In fact we anticipate a total of 50 conversion orders will be placed this year, so the prospects are not displeasing. Ten of the above lists of vessels are having Diesel-electric drive. A number of the engines are Shipping Board sets. Just at the moment the best opportunities for securing immediate business are available to marine equipment manufacturers, who in their own interests should use our advertising pages to give the necessary publicity to their products. Shipowners and their naval architects considering new motorship building or steamer conversion, are naturally keenly reading this magazine. Also renewals of equipment are required from time to time by vessels already in service.

AMERICAN MOTORSHIPS AT PRESENT UNDER CONSTRUCTION, OR STEAMERS BEING CONVERTED TO DIESEL POWER OF 1,000 TONS DEADWEIGHT OR OVER.

Owner	*Make of Oil-engine*	*Type of Vessel*	*D. W. C. Tonnage*	*Shaft Horsepower*
Standard Oil of Cal.	Pacific-Werkspoor	Barge	8,000	1,700
Standard Oil of Cal.	Pacific-Werkspoor	Tanker	1,875	600
Benson Lumber Co.	Pacific-Werkspoor	Freighter	4,400	850
Sun Shipbuilding Co.	Sun-Doxford	Tanker	11,000	2,500
Sun Shipbuilding Co.	Sun-Doxford	Freighter	11,000	2,500
Sun Shipbuilding Co.	Sun-Doxford	Freighter	11,000	2,500
New York Shipbuilding Co.	New York-Werkspoor	Freighter	8,800	1,500
New York Shipbuilding Co.	New York-Werkspoor	Freighter	8,800	1,500
Golden Gate Ferry Co.	Pacific-Werkspoor	Ferry	1,000	1,050
Moore Shipbuilding Co.	Pacific-Werkspoor	Freighter	4,400	850
Moore Shipbuilding Co.	Pacific-Werkspoor	Freighter	4,400	850
Moore Shipbuilding Co.	Pacific-Werkspoor	Freighter	4,400	850
Moore Shipbuilding Co.	Pacific-Werkspoor	Freighter	4,400	850
Submarine Boat Corp.	Craig	Freighter	5,500	1,850
Cramp Shipbuilding Co.	Cramp-Burmeister	Freighter	8,800	1,850
Cramp Shipbuilding Co.	Cramp-Burmeister	Freighter	8,800	1,850
Munson Line	McIntosh & Seymour	Freighter	4,200	750
Standard Transportation Co.	McIntosh & Seymour	Canal-Vessel	1,800	600
Port of Portland, Ore.	McIntosh & Seymour	Dredge	1,000	1,500
U. S. Steel Co.	McIntosh & Seymour	Freighter	2,000	750
U. S. Steel Co.	McIntosh & Seymour	Freighter	2,000	750
U. S. War Dept.	McIntosh & Seymour	Dredge	2,000	3,000
U. S. War Dept.	McIntosh & Seymour	Dredge	2,000	3,000
U. S. War Dept.	McIntosh & Seymour	Dredge	2,000	3,000
U. S. War Dept.	McIntosh & Seymour	Dredge	2,000	3,000
U. S. War Dept.	McIntosh & Seymour	Pipe-Line Dredge.	1,200	900
McDougal Terminal Co.	Lombard	Canal-Freighter	1,800	750
McDougal Terminal Co.	Lombard	Canal-Freighter	1,800	750

Total.. 28 vessels, 131,175 tons 42,400 shaft h.p.

Diesel-Electric Ferry "Poughkeepsie's" Performance

Installation of Falk Reduction Gears and New Propellers Improves Speed and Manoeuvring Qualities

IT will be remembered that when the Poughkeepsie & Highland Ferry Co. Diesel-electric ferry POUGHKEEPSIE first went into operation late last Summer that her speed was not what was expected. This was discussed in the September, 1922, issue of MOTORSHIP and the fact was pointed out that her Winton Diesel-Westinghouse electric generating and propelling set was delivering in excess of the guaranteed horsepower. Failure to make the desired speed lay, therefore, in propellers too large for the power and motor speed and too low power. It is unfortunate that this should occur in the case of this first Diesel-electric ferry in the New York district whose operation was watched so closely, because many felt that some trouble was present which was inherent with Diesel-driven craft. They forgot that many a steamship has failed at first to make the desired speed and that many changes of propeller were needed before she did.

Therefore, the manner in which the POUGHKEEPSIE's performance was improved will doubtless interest our readers. As will be remembered, she is of the "Arconstruct-Hullfin" type, in which there is a fin extending below the usual hull of the boat and in this hullfin are located the electric-motors which turn the propellers at each end of the fin. Its chief purpose is to place the propellers under the boat, where they are always immersed in solid water. It also enables the POUGHKEEPSIE to act as an ice-breaker. Instead of wedging into the ice, as a boat with a standard hull will do, the broad end of the POUGHKEEPSIE rides over it, crushes it, and then pushes it aside. The position of the propellers on the hullfin prevents them from being injured during the process. No very heavy ice has been encountered in the river so far this winter, but it is expected that the POUGHKEEPSIE can keep in operation with even the maximum thickness of ice, which sometimes exceeds two feet at this point.

Steering-wheel and electric control in the pilot house of the "Poughkeepsie"

This is the first commercial craft to be built embodying the combined "Hullfin" and "Arconstruct" principles. This combination is known as the "Wyckoff System," of C. V. S. Wyckoff. The "Hullfin" was invented and patented by Capt. S. Golden, President of the Hullfin Boat Company, Inc., and the "Arconstruct" principle was patented by Frank Nichols, all of New York City.

She was built in the Mill Basin, Brooklyn, yards of the Atlantic, Gulf & Pacific Company and has a length over guards of 140 feet, beam over guards of 52 feet, total draft of 10 feet, hullfin draft of 6 feet, and a displacement of 400 tons. Her hull is of steel and her superstructure of wood with steel supports, trusses and tie-rods. At each end of the hull, there is a special system of framing and extra heavy plating designed to provide the resistance necessary for the ice-crushing service. The hull itself extends to the fender-guards, furnishing maximum stability and eliminating the overhanging guards and braces in general use.

The engines are of the Winton-Diesel type, with six 7½" x 11" cylinders, and operate at 450 r.p.m. The main Westinghouse generators are rated at 90 kilowatts each and supply 250-volt direct current. Two 9-kilowatt Westinghouse generators, driven from the main-engines, furnish excitation for the main-generators and motors, as well as power for lighting and other purposes when the vessel is in operation. For use when the main-engines are shut down, there is a 7½-kilowatt gasolene-driven generator. This supplies sufficient power for lights and also for operating a small motor-driven compressor which provides air at 600 lbs, pressure for starting the main engines. These operate continuously at constant speed in one direction only during the operation of the boat, all speed changes in the boat's movements being made by changing the speed or direction of rotation of the motors. Either or both engines can be used at any time.

A small rheostat, located under the floor of each pilot-house and operated by the pilot's controller, controls the motors by varying the voltage and the direction of the main generator field-current supplied by the exciters. The amount of current handled by the rheostat is small, so that the control equipment is very light. In addition to the controllers in the pilot-houses, there is a third one in the engine-room for emergency purposes. A switch prevents the use of more than one controller at a time. Should the circuit-breakers, which protect the main-circuits by opening automatically on overloads, operate and cut off the current

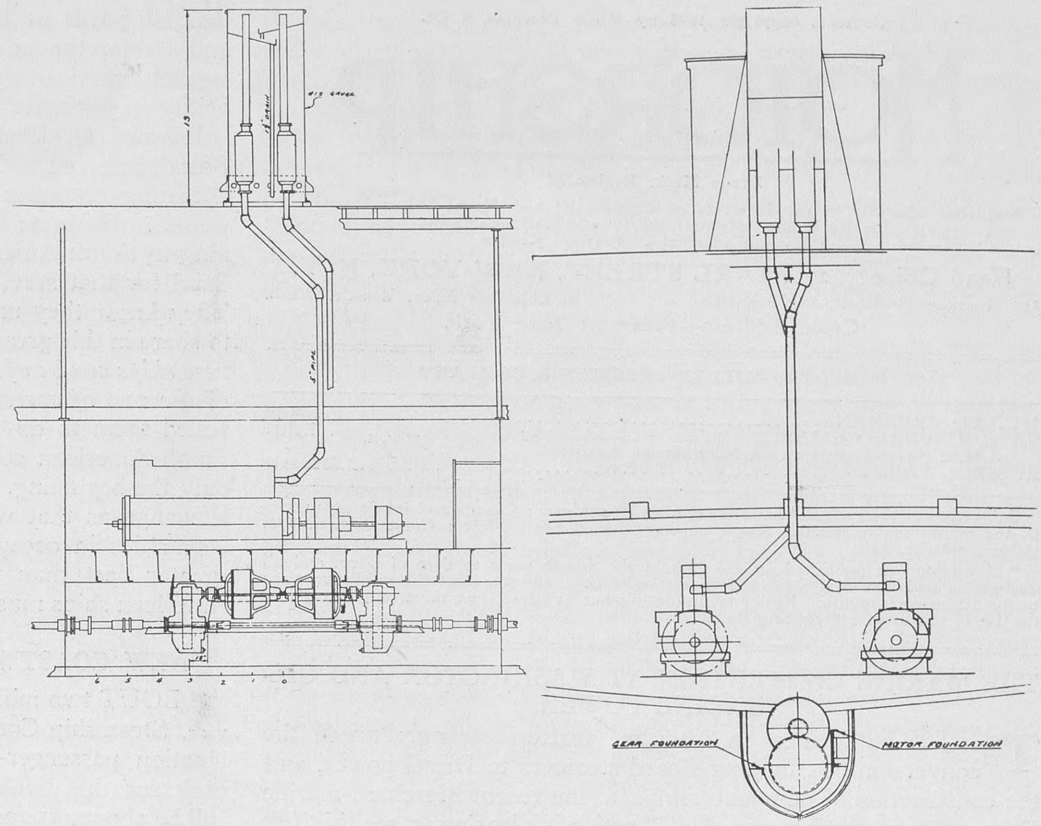
The Winton-Westinghouse Diesel-electric propelled ferry boat "Poughkeep sie" running on schedule following the installation of Falk reduction-gears and Falk-Bibby flexible couplings

to the propeller-motors, they are reset by pressing a button located on each controller. All the controlling and switchboard apparatus is of Westinghouse make.

As originally designed, the propeller-motors, which operate from 600 to 720 r.p.m., maximum, were connected directly to the propeller-shaft. It was not possible, however, to obtain full speed with the 48" x 26" propellers then used. Tams & King were retained as consulting engineers to correct this trouble, and Falk herring-bone gears, giving a 3¼ to 1 reduction, and Falk-Bibby flexible couplings were installed between the motors and the propeller-shaft, and 60" x 60", semi-steel Kearfott propellers, to operate at about 220 r.p.m. were substituted for the original ones. The result of these changes was the gain of about 45% in the POUGHKEEPSIE's speed, so that she now runs at about 9 miles per hour. Normally both motors and both propellers are operated so as to give ample power and eliminate the drag due to the forward propeller, but either motor or either propeller can be cut out if desired.

In the opinion of the naval architects, this geared arrangement forms an excellent drive and one that deserves careful consideration in designing future boats of this general character. The combined weight of the high-speed motors and the gears is less than that of motors of sufficiently slow speed without gears for direct connection to the shaft; a low shaft-line is made possible while the motors are raised up where they are accessible, well ventilated, and kept clear of the bilge; perfectly silent operation is obtained at the low peripheral speeds employed; and the life of the gears should be practically unlimited.

There are several reasons why Diesel-electric drive was adopted. The most important is its high fuel economy. There is every reason to believe that the POUGHKEEPSIE can develop a brake-horsepower per hour on less than a half a pound of oil, whereas she would certainly require over a pound of oil to develop the same amount of power if she had the most efficient form of steam-engine. In addition, she has no standby losses whatsoever. Consequently, when sufficient data is accumulated it is fully expected that the daily fuel-cost of the



Arrangement of engines, electric motors, reduction-gears and exhausts on the ferry boat "Poughkeepsie"

POUGHKEEPSIE will prove to be about one-third of that required by a steam-operated vessel of similar power and hull size.

Another advantage is the compactness of the machinery. It can all be contained within the hull without a superstructure, leaving the main deck perfectly clear and providing room for four lines of automobiles in addition to the passenger cabins on either side. The POUGHKEEPSIE's car capacity is therefore practically double what it would be with steam propulsion.

Finally, the pilot has absolute control over the movements of the vessel. By merely moving a small handle located behind the wheel in each pilot-house, he can start, stop, reverse, or change the speed of the boat without the loss of an instant's time or the slightest opportunity of having his signals misunderstood. So efficient is this control that the POUGHKEEPSIE can be brought from full speed ahead to full speed astern in less than a minute.

The two cabins of the POUGHKEEPSIE will seat 190 passengers. If traffic demands, these cabins can be put on the upper-deck. The heating apparatus consists of an Arcola steam-heater. An air-operated Strombos horn is used for signalling. Fuel-oil tanks with 4,400 gallons capacity—over a month's supply—are located in the compartments at the ends of the hull. The steering-gear is of the Thames multiple hand-operated type.

Special credit must be accorded S. A. Crum, President of the Poughkeepsie & Highland Ferry Company, for his enterprise in building a boat that marks such an important step in the advance of marine engineering. She was built under the personal supervision of Albert B. Hager, Vice-President of the Atlantic, Gulf & Pacific Company.

BIG REDUCTION-GEARED MOTORSHIP

Reduction-gears between the propeller-shafts and the fast-running marine Diesel-engines will be a feature of the new 12,000 gross tons passenger motor-liner building at the Blohm & Voss yard, Hamburg, for the Hamburg-American Line for delivery at the end of this year. This 13½-knot twin-screw ship will carry 2,490 passengers and cargo. Evidently this great German ship-owning company are fully satisfied with their two-geared Diesel motorships HAVELLAND and MUNSTERLAND. No steam will be used on this ship, and the exhaust-gases will be used for heating purposes, augmented by electric radiators.

OTHER SHIPOWNING COMPANIES PLEASE NOTE

A. Hebble, the Superintendent-Engineer of the Southern Pacific Steamship Company (Morgan Lines), has just sailed for Europe where he will spend two months doing nothing but investigating Diesel-engine and motorship construction in Great Britain, Norway, Sweden, Denmark, Holland, Germany, Belgium, Switzerland, France and Italy. This is following visits to some of the principal American Diesel-engine plants such as the Busch-Sulzer, Nordberg, McIntosh & Seymour, Pacific-Diesel and Cramps.

The company is contemplating important additions to their fleet and the new vessels will be of about 6,000 h.p., and the directors have decided that it would be poor policy to instal any type of steam machinery until they have made an exhaustive study of Diesel-engines and motorships. Also, they have decided that if they do adopt oil-engine power they will not be content with anything but the very best engine, whether domestic or foreign. Hence this visit abroad, which will enable them to decide whether or not American engines are equal to or better than any foreign production.

THE SUPPLEMENT

Work on the special artistic advertising Supplement to MOTORSHIP is almost completed and the distribution will soon be made. In addition to the further tests of the new oil-engine described therein, delay has been caused through illness of the chief-engineer in charge of the design, construction and test work.

EDITORIAL ASSISTANT REQUIRED

There is an opening on the editorial staff of this publication. The principal requirements are general working knowledge of the subjects treated by this journal and ability to write in a clear and interesting manner. Communications giving full particulars should be sent by mail pending a personal interview.

OIL ENGINE BUILDERS ASSOCIATION

The Oil Engine Builders' Association held a regular meeting on January 18, 1923, at the Athletic Club, Cleveland, Ohio. Matters of importance to the oil-engine industry were freely discussed, but the keynote of the discussions, however, was "better sales ethics."

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THE MARINE CONVENTION AT WASHINGTON AND OIL-ENGINE POWER

THREE authorities on maritime matters strongly urged the conversion of Shipping Board steamers to Diesel power, and the construction of new motorships, at the recent Merchant-marine Convention at Washington, D. C., and it is pleasing to see this full endorsement of our own policy. Speaking as an owner of both steam and motor vessels Frank C. Munson, president of the Munson Line of New York, laid very heavy stress on the remarkable economies to be secured by "Dieselizing" existing ships and urged other owners to carry out such work, quoting figures regarding present motorship building in Europe. He also referred to the immense boon it would be to marine equipment manufacturers and to the nation's shipyards which now were almost depleted of work and at their lowest ebb in history. It was clear from Mr. Munson's unbiased remarks that he has implicit confidence in the great benefits that will accrue to the merchant marine from more extensive adoption of Diesel or Diesel-electric power.

Robert Haig, vice-president of the Sun Shipbuilding Company, Chester, Pa., was equally insistent as to the value of the oil-engine for ships. He said: "Today the world is on the eve of discarding the steam-driven vessel and installing the Diesel engine with its great and manifold advantages of lower costs of operation, so great that our failure to grasp this opportunity to encourage our shipowners to go out and secure for the country the full advantages of this stupendous change, will be shortsighted, will be almost criminal, and will be a loss that cannot be readily repaired. America, that has led the world in the development of the oil industry, is pre-eminently fitted and deeply interested in the Diesel engine for ship and land power, and will welcome and encourage this change. Ship owners are eager to make full use of the opportunity to again show American ships trading on every sea, equipped with the best that can be devised, manned by native crews, fitting in every respect to represent a great nation. A subsidy will encourage the ship-building yards to keep abreast of modern practice, to investigate and develop the most economical forms of power and construction, so that American ships will be in the forefront in type, quality and ability to perform."

Edward G. Plummer, Commissioner of the U. S. Shipping Board, referred to Great Britain building motorships to secure low operating costs for the purpose of competing against American vessels. He said: "Already those Shipping Board steamers running to South America have compelled our British competitors to build for that service three 10,000-ton Diesel-engined motorships. They know they must make the lowest possible rates if they are to share in this great ocean business of the United States, *and these new ships can be operated on those long runs at less than two-thirds of the cost of corresponding steamships.* That's what we've compelled them to do—to the mutual benefit of the people of those South American countries and of the United States. But this is only the beginning. Ocean service is on the threshold of as great a change as that which followed the advent of steam. Coming economies in ocean transportation will create employment for a greater fleet than the world ever has known, and in that fleet American ships must have their proper place."

WHAT WE SAID IN 1919

(When Shipping Was at the Peak of Prosperity)

A Forecast That Has Proved Absolutely Accurate

"We maintain that if the demand for freight carrying-bottoms drops to any considerable extent, and if European and Japanese shipowners commence rate-cutting, it will be practically impossible for American shipowners to operate a huge fleet of oil-fired and coal-burning steamers without heavy Government subsidies!"

"We have come to the conclusion that when serious competition for ocean-trade arrives, American shipowners will find it unprofitable to operate oil-fired steamers except on certain limited routes, and gradually such craft will be laid-up or sold to foreign buyers, with the result that less than ten years from now will see America's hopes of great mercantile-marine shattered. The salvation of our merchant-marine rests with the economical Diesel-engined vessel, which at least can compete against foreign oil-fired and coal burning steamers, and which will stand a much better chance against foreign motorships, because our own Diesel craft also can sell part of their bunker-oil when at a European port, and so operate without a fuel-bill, which steamers cannot do!

Extract from "Motorship," December 1919.

NEW COASTWISE SHIPS AND THEIR MACHINERY

ABOUT two million dollars is to be spent this year by the Clyde Steamship Company of New York building a couple of combination passenger-and-cargo vessels of about 4,000 gross tons each for this line's coastwise service. The length of the ships will be about 425 feet with 57-foot breadth, and a fair turn of speed will be required, but if Diesel-engines, or Diesel-electric drive, are installed the saving in machinery, water and bunker space and weight would enable the hulls to have almost the same capacity and speed with smaller overall dimensions, the exact amount depending upon the type and design of oil-engine power adopted. As this company and its naval architect have not yet shown any tendency to adopt Diesel power, it perhaps will be a question of—not what make of motor shall be purchased but what type of steam machinery shall be installed, with Diesels only receiving light consideration. Some of these remarks also apply to the New York & Porto Rico Steamship Company, who are asking bids on a 15½-knot passenger vessel.

Therefore, we suggest that the leading oil-engine builders of the country make more than ordinary salesmen's efforts and provide the owners and their naval architect, Theodore Ferris, with really valuable information, which can be produced from a careful study of the plans of the vessels and their particular service. Regardless of any opinion held by the officials concerning advantages or disadvantages of oil-engine power, it cannot be otherwise than to their advantage to furnish adequate facilities for making the desirable constructive comparisons with steam power. We feel that unless something is done along these lines the new vessels will be built with steam propulsion.

As Clyde Company's ships do not have to make long non-stop runs, we consider that—provided efficient propellers can be used—engines turning between 175 and 225 r.p.m. will give more than the reliability and durability required, and will have the advantages of low cost, light weight, space saving and accessibility, with the result of the entire job not costing more than steam of equal con-

structional quality. The Hamburg-America Line has now had very satisfactory experience with two 10,000 tons cargo motorships of which the twin-Diesel engines run at 230 r.p.m. Yet in these two cases the engines are of very light construction and were not built for such heavy-duty work. The weight of the complete engine-room machinery is only 250 tons for the total of 3,300 shaft horsepower developed, or 152 lbs. per s.h.p. This, of course, is very light, being lighter than steam plants, and probably too light for the Clyde Line boats. Nevertheless, it has demonstrated itself to be reliable on trans-ocean routes pushing full-lined hulls of 14,700 tons loaded displacement through the water for fifteen and twenty days at a stretch. Consequently engines of a type somewhere between these engines and the heavy, slow-speed crosshead engines of the average motor freighter should produce the best all-around results for the Clyde and the N. Y.-P. R. liners, and if lower propeller speed is necessary or desired, reduction-gears or electric transmission could be utilized.

VIEWS OF A BRITISH SHIPOWNER

SPEAKING at a directors' meeting of the Court Steamship Line in London on January 18th, Sir Laurence Phillips, the chairman, stated that "weighty consideration had been given as to whether a ship just ordered should be Diesel or steam driven. Internal-combustion power had great advantages; but there were also great disadvantages. The engines were very complicated, and very heavy, which affected cargo possibilities. Beyond all that they were not certain about their reliability, and furthermore they were very expensive. For a liner the reliability did not matter so much, because the liner could arrange to have a workshop with spare parts at each end of the voyage. On the other hand, with cargo steamers that had to go to outlandish ports very often, if they had a breakdown there were no facilities for repairs. In view of all those facts, as far as his company was concerned, they were quite willing to let other companies do the experimenting with Diesel engines for marine purposes for some time to come. They would stick to steam!"

In reply to Sir Laurence we believe that as in the case of some American shipowners his views must have been formed by his technical advisers having given him such misleading data as is published (together with our comments) on page 116 of our February number. Sir Laurence states that the weights of Diesel engines are heavy and affect cargo capacity, the engines themselves are complicated, and their reliability is uncertain, three points which actually are far from the case. In opposition to this belief, let us quote the motorship HALLFRIED as a typical case whose weights, capacities, and reliability are fully outlined on pages 106, 108 and 109 of our February number. She has the following weights:

Power	2,800 i.h.p. at 125 r.p.m.
Weight of main engines (2)	240 tons (total)
Weight of engine-room auxiliaries, equipment, etc.	180 tons (about)
Weight of fresh water (including for crew and boilers)	44 tons
Weight of fuel for 30 days' voyage at 10½ knots speed	220 tons
Total	684 tons

We believe that any of the Court Line steamers of similar power and size will show weights exceeding the following:

Weight of main engine, boilers, condensers and auxiliaries	325 tons
Weight of water in boiler and tanks (including for crew)	175 tons
Weight of fuel (oil or coal) for 30 days at 10½ knots speed	675 tons
Total	1,175 tons

While we have conservatively underestimated the weight of the steam engine and boilers, there is a gain in weight to the advantage of Diesel power of at least 491 tons so that extra amount of cargo can be carried. With some designs of Diesel engines, however, these weights will be exceeded by 150 tons, and will be 50 tons less with several others, such as the Fullagar and Nobel. As regards reliability, the majority of motorships in service have definitely proven to be even more reliable than steam. For instance, the WILLIAM PENN has made two six-month voyages around the world with less than fifty dollars ($50) in engine-room repairs. Then there is the reliability of the KENNECOTT, CALIFORNIAN and MISSOURIAN, which have been operating without engine repair bills. While the cost of the Diesel plant is about 30% more than steam, it only adds 10% to 12% to the total cost of the vessel. However, the resultant ship is 12% larger in cargo capacity, which, in one sense, evens matters as to first cost and interest. But she can be made 12% smaller than the steamer and thus virtually result in having the same first cost and carrying capacity.

The views of all important British shipping men naturally do not coincide with these of Sir Laurence Phillips, as is clearly shown by the remarks of Sir James McKechnie, managing-director of Vickers, Ltd., made a few days previously. But as to whose views are correct it is sufficient to say that while Sir Laurence has had no personal experience with motorships, the experiences of Sir James cover many such craft, as well as numerous steamships.

Sir James McKechnie's remarks were as follows: "That the internal-combustion engine has justified its adoption there can be no doubt. The economies which it offers in respect of *weight, space and running expenses* are advantages which appeal very strongly to shipowners. It is admittedly somewhat more expensive to manufacture, but in service it more than compensates for the comparatively high first cost. Moreover, that *its reliability is now established* in the minds of shipowners is shown by the steadily increasing number of vessels fitted with it which are produced yearly. The increasing popularity of internal-combustion machinery is resulting in the production of a multiplicity of types, and largely because of this it is difficult for superintendent engineers to decide as to which is most suitable for their purpose. The four-stroke type is still the most popular, although the two-stroke type possesses numerous adherents. At the present stage of development it is not possible to dogmatise as to which possesses the most advantages. Such a decision can only be arrived at after comparing results obtained by typical sets of engines under actual service conditions for a long time." Incidentally Sir James' comments on the four-cycle and two-cycle type are very impartial, and it is pleasing to note his attitude although his company manufactures four-cycle engines only.

MOTORSHIPS LAUNCHED DURING 1922

ACCORDING to Lloyd's Register of Shipping, there were actually launched during 1922, eighty-six motorships of 131,216 gross tons (about 210,000 tons deadweight) in countries other than Great Britain, and seventeen British motorships of 78,341 gross tons (about 125,000 tons deadweight). Thus there were 103 oil-engined vessels aggregating about 335,000 gross tons that took the water last year aside from a good number left on the ways. Yet this was during the worst depression in *steam*ship building known for many years. Some large auxiliaries are included in these figures. It is interesting to note that the number of full-powered motorships has steadily increased each year to date since 1912, while since 1920 *steam*ship construction has very rapidly dropped, clearly indicating the trend of the shipowner's mind.

PRESENT CONDITION OF INDUSTRY

THOSE who take the trouble to peruse all articles and paragraphs, especially the latter, in this issue probably will be surprised to see the amount of new orders, launchings, etc., both in the merchant motorship and motor work-boat industries. As Coué intimates, "things are getting better every day in every way!" When we recall that several years ago there was hardly an oil-engined work-boat in this country and that at the end of the war merchant-motorships represented only 2.4 per cent. of the world's total tonnage, the fact that the proportion of motorships launched last year was over 10 per cent., the gain is truly significant, particularly as it comes at a time of shipping depression, and the percentage does not include the work-boats. It can mean but one thing, that the oil-engine for mercantile purposes is now on a rock-bottom basis, and vessels will be equipped with this type of power in times of depression as well as in times of prosperity. It is to this particular branch of the shipbuilding industry that American equipment manufacturers in this country must look for their future orders, particularly as immediate-future prospects are exceedingly bright, especially if the Subsidy Bill passes Congress.

THE AGE OF PROGRESS!

The turbines will be removed from the Standard Oil Co.'s tankers JOSIA MACEY and S. V. HARKNESS and will be replaced by new Hoovens, Owens & Rentschler *reciprocating steam-engines.*

New Spanish Motorship "Arantza Mendi"

Single-Screw Diesel-Driven Freighter for Sota y Aznar of Bilbao

Spain has not made very much headway in the construction of motorships, although several such vessels have been built in Great Britain for Spanish owners and some small Sulzer-engined craft have been built in Spain. Recently we referred to a new motorship building at Bilbao, Spain, to the order of Sota y. Aznar of the same port. In sending us the following details of their new craft this shipowning company remind us that they are subscribers to MOTORSHIP, which magazine we are pleased to note they consider valuable. Consequently, we should not be surprised if the numerous articles on oil-engine economy we have published carried some weight in their decision when they ordered Diesel power for their new ship ARANTZA MENDI. The Diesel engine of this vessel, by the way, is being built by John G. Kincaid & Co., Greenock, Scotland, under Harland & Wolff-Burmeister & Wain license.

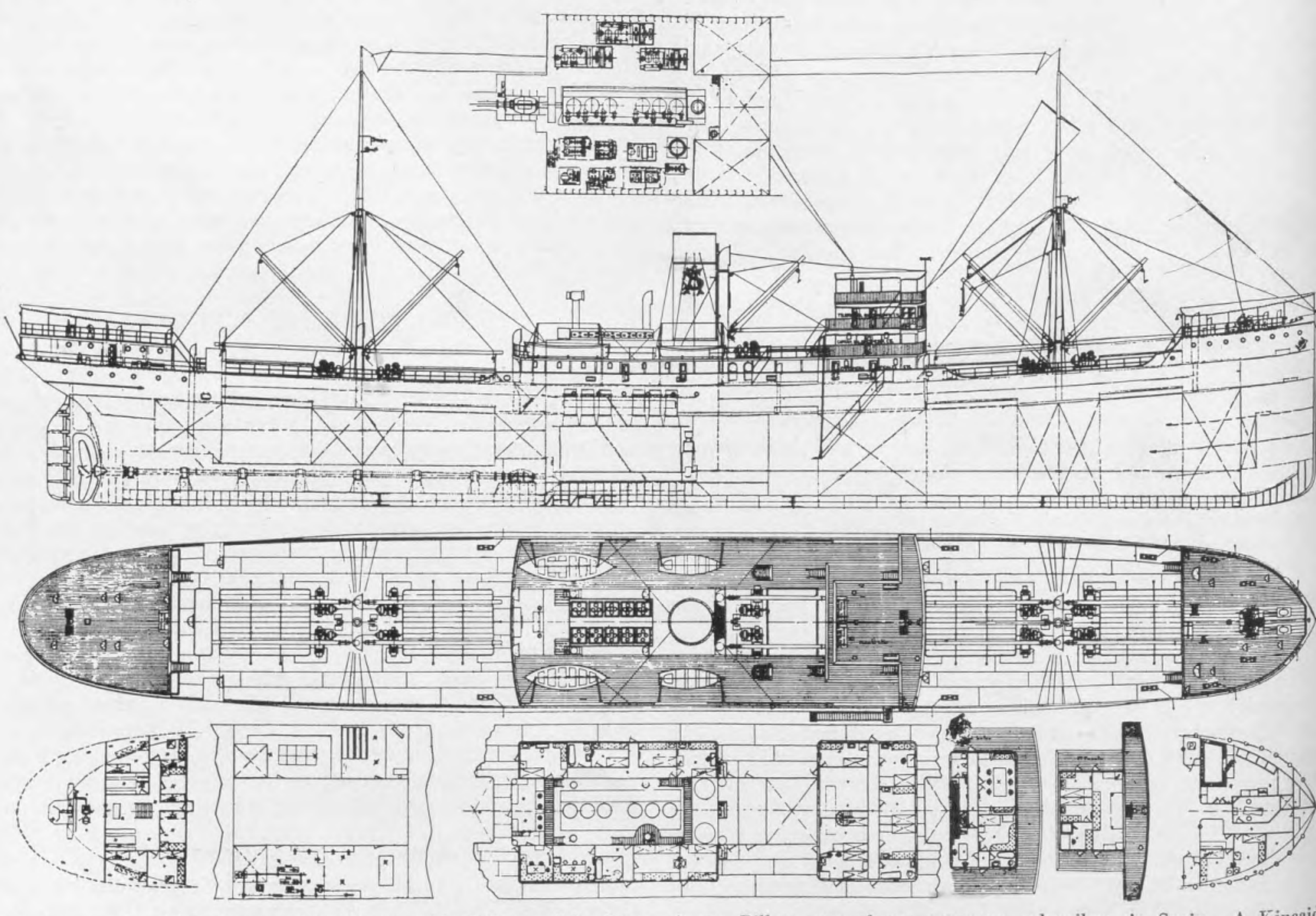
The ARANTZA MENDI has the following general dimensions, etc., and was launched on January 4th last at the shipyard of the Compania Euskalduna de Construccion y Reparacion of Bilbao, Spain.

Displacement (loaded)	8,603 tons
Displacement (light)	2,603 tons
Maximum Net-Cargo capacity on 10,000 miles voyage (*not* including fuel water and stores)	5,645 tons
Cubic Capacity of Holds (grain)	340,365 cu. ft.
Cubic Capacity of Deep Tank	18,903 cu. ft.
Weight Capacity of Deep Tank (oil-cargo or fuel)	540 tons
Capacity of Double-bottoms (oil-fuel)	194 tons
Deadweight Capacity [a misleading term—*Editor*]	6,000 tons
Length of Engine-room	40'4"
Ind. h.p. of Main Engine	2,300
Shaft h.p. of Main Engine	1,800
Daily fuel-consumption (loaded at sea)	8½ tons
Port daily-fuel-consumption	0.5 to 1.6 tons
Daily lubricating-oil consumption	50 kg.
Ship's loaded speed	10½ knots
Speed of Main Engine (max.)	90 r.p.m.
Cruising-radius including deep tank	80 days, or 20,160 naut. miles
Weight of Main Engine	220 tons
Weight of Complete Engine-room machinery, including propeller, shafting and all auxiliaries	500 tons
Fresh-water carried	40 tons
Number of Engine-room crew	9 men
Deck winches (by Sunderland Forge Co.)	10 electric
Bore and Stroke of Main Engine six-cylinders 4-cycle)	29.134" by 59.055"
Length of Ship (O. A.)	360'0"
Length of Ship (B. P.)	345'0"
Breadth (moulded)	48'6"
Depth (moulded to U. D.)	24'10"
Mean Loaded Draft	22'10"

It will be noted that she is a single-screw ship, with a big slow-speed Diesel engine turning at 90 r.p.m. and will be somewhat similar in size and power to the SEEKONK now being converted at Cramp's shipyard. Her engine-room is only 40' 4" long, and on a deadweight of 6,000 tons she can carry 5,645 tons of net cargo a distance of 10,000 nautical miles without re-bunkering, once again showing that the term deadweight should be abolished because an oil-fired steamer could not carry more than 5,000 tons of net-cargo over the same distance unless she stopped to re-fuel, or 645 tons less than this motorship.

Hence, the shipowner who compares the prices of motorships with those of steamers at "so-much per d.w. ton" is misleading himself, because with two craft of equal deadweight tonnage and power the motorship is the larger and faster vessel. It is time shipowners got together and abolished the term deadweight in their own interests, but unfortunately the expression has become a habit through many years usage, and was quite practical until the situation was changed by the inception of the motorship.

The bunker-capacity in the double-bottom of the new Spanish vessel is only 194 tons, but this quantity of fuel will run the ship for 27 days at sea, or 7,800 miles. When longer distances have to be covered without fueling the deep-tank can be used, but it is obvious that on most voyages, the 18,903 cubic feet of deep-tank capacity can be used for dry or oil cargo, giving the vessel at least 540 tons of cargo carrying benefit over a steamer under average *short voyage* conditions. On long voyages, of course, the "extra cargo capacity" will be greater, and will be at least 645 tons more than a steamer and perhaps 750 tons. The maximum fresh-water capacity of the motorship it will be noticed is only 40 tons, whereas the steamer's water requirement will infringe on her cargo to the extent of about 175 tons.



Single-screw Spanish-built motorship "Arantza Mendi," owned by Sota y Aznar, Bilbao, one of our numerous subscribers in Spain. A Kincaid-Burmeister & Wain 1,600 i.h.p. engine is being installed

Salt Water in Suspension

Its Detrimental Effect on Diesel Motors

By A. B. NEWELL

WHEN a Diesel engine fails to function as it should we should not jump to the conclusion that some inherent mechanical defect, or the quality of the fuel or lubricating oil is causing the difficulty. The root of the trouble may be something entirely apart from the engine. For instance, leaking rivets in the bottom of a fuel tank may make it appear that the lubrication of the working cylinders is not right. Sea water may find its way into the fuel tanks through bad rivets, poor tank covers, a leaking fuel line or last and most probably, as the result of using double bottoms for water ballast and fuel alternately, without being careful to thoroughly clear them of the former before filling them with the latter.

With fuel and salt water in the same tank the agitation set up by the rolling of the ship will shortly start an emulsification which will spread the salt water throughout the fuel, there to be held in suspension. This will take place even with very light grades of Diesel-engine fuel. Once the water has gone into suspension there is no practical method of completely separating it aboard ship, although the application of heat will help, as will a centrifugal separator.

Authorities differ as to what is the best temperature at which to carry fuel-oil for the purpose of breaking down an emulsion, different ones advocating different degrees of heat ranging from 125° F. to 180° F. I have found that by raising the temperature of the fuel in the main storage tanks to about 90° F. that a portion of the water will be dropped there. After transferring to the daily service, or settling tanks, a temperature maintained at 150° proves very satisfactory.

Almost all of the evils which can befall an oil-engine will become manifest as the result of salt-water in suspension in the fuel. Thus the operating engineer will find himself confounded if he has never been confronted with the problem before. With a four-cycle air-injection motor, which is the most sensitive type, exhaust valves will rapidly and repeatedly give trouble, fuel valves will become leaky, burner-plate holes will increase in size with a corresponding overload on the compressor, while atomization will become poor which in turn will bring about poor combustion and great clots of a black mucky substance will fall from the lower ends of the pistons. Finally, excessive wear will be noted on the cylinder walls and rings, and escaping gases will seriously interfere with lubrication.

These conditions will come about gradually and for some time the engine will run normally for the amount of water carried in suspension is very little and does not noticeably interfere with combustion. The intense heat of combustion will immediately convert this water to superheated steam, to be expelled with the exhaust gases. The salt will fuse and fine molten particles will float in the gases, spreading over the cylinder walls and head and on top of the piston.

When the scavenging stroke takes place the high velocity of the outrushing gases will sweep these fine particles of molten salt against the exhaust valve and seat, there to cling and form a thick, hard coat. This coat formed between the valve and seat will withstand the pressure within the cylinder for several days, but will finally break and allow the fire to burn the valve and a corresponding spot on the seat.

When the valve is removed it will be found covered with a hard, brown substance much resembling the residue left after burning sulphur upon a cold plate. I once mistook it for sulphur, but upon having it analyzed I learned that it contained 95 per cent. chlorine, a trace of sulphur, a very little sulphate of iron and some carbon.

The action upon the fuel valves and burner plates will be much slower and of an entirely different nature from that upon the exhaust valves. After about thirty days of running it will be found necessary to remove them and their condition will be found to be so bad that it would seem a marvel that they worked at all. The tip of the needle-valve and its seat will be found to be badly eroded and it will be necessary to reface the one and ream the other to give them their original shape, for no amount of grinding could put them in good condition again.

> **Engine-Room Operation of Motorships**
>
> This is the first of a series of interesting articles on the operation of motorships' machinery we are publishing from the pen of the Chief-Engineer of an American Diesel-engined motorship. All deal from the practical point of an experienced operator.—*The Editor.*

The holes in the burner plates will not only be enlarged but will be distorted in shape, with rough and jagged edges making them appear as if they had been attacked by an acid which had eaten away certain alloys of the metal and left others. This will have been the action of salt water and air, entirely different from a sand blast or the rapid and incessant passage of grit through the holes.

A disassembly of the flue pumps and removal of the atomizers will reveal small pits in the metal which has been in contact with the fuel. They are of no consequence, but merely give further proof of the presence of salt water.

The fine particles of salt deposited upon the cylinder walls are picked up by the rings and mixed with the lubricating oil. Its action is of a grinding nature similar to a slow *lap* and will cut at the rate of about one-fourth of one-thousandth of an inch (1/4000″) in twenty-four hours running if the condition be very bad; but in mild cases the wear is very slow, perhaps three times the normal rate.

Strange as it may seem the salt has no tendency to "stick" the rings. It is inclined to free them and when combustion is poor and the pistons become badly fouled with carbon the rings will be found free enough to be removed without breaking. However, with a trunk-piston type of engine it is a serious menace to the piston-pin bearing for it is not soluble in oil and fills the oil ways, often causing a box to burn out.

In the absence of exhaust valves in the two-cycle engine, the first warning may be worn cylinders and rings. With the four-cycle engine the exhaust valves give early warning. Consequently the two-cycle engine may suffer greater damage than the four-cycle before the trouble is discovered.

With an airless-injection engine the absence of air will cause the action of salt water to be slower and vital parts of the engine may suffer, while with air atomization the destruction of the atomizing apparatus would give warning. While burning fuel carrying water in suspension the two-cycle airless injection motor may run longer than the four-cycle engine without giving trouble. However, when the trouble comes it will be of a far more serious nature.

There is no need of providing elaborate equipment for the purpose of separating salt water from fuel aboard of a motor vessel, although a heating arrangement should be provided, and the engineers should be prepared to use the means at hand to separate as much of it as possible. It is best to use care in preventing water from ever entering a tank with fuel: Lock the stable before the horse is stolen!

In any event the vessel will come safely to port, but if salt water has given trouble at sea an investigation of its source should be made at the first port at which a fresh supply of fuel can be obtained and no expense should be spared in making the tanks tight. A supply of clean fuel will stop salt-water trouble as if by the stroke of a magic wand. However, no amount of writing can as clearly demonstrate this as will a single experience with it.

MR. CHALONER OPENS CONSULTING OFFICE

We are advised that J. L. Chaloner, the well-known British fuel-oil and oil-engine expert, who until recently was technical advisor of the Anglo-Mexican Petroleum Company of London and New York, and who has contributed many interesting technical articles to MOTORSHIP, has opened his own practice as consulting-engineer at Abbey House, 8 Victoria Street, Westminster, London, S. W. 1, England. Mr. Chaloner will continue contributing his excellent articles to MOTORSHIP and to our companion magazine OIL ENGINE POWER.

TWO DIESEL TUGS ORDERED BY SAN PEDRO FIRM

The Wilmington Transportation Co., San Pedro, Calif., have placed an order with William Muller, shipbuilder of Wilmington, for two powerful Diesel-tugs and two lighters. Each of the tugs will be equipped with a 350 h.p. Diesel-engine and will be of the following dimensions: Length, 90′, 0″; breadth, 19′ 0″; draft, 10′ 6″. The cost of these tugs will be about $75,000 each, while the lighters will cost about $15,000 each, and all will be completed early in the Spring. According to J. H. Patrick, president of the Wilmington Transportation Co., these craft will be equal to any tug on the Coast, and they will be named DAVID T. FLEMING, secretary-treasurer, and D. M. RENTON, vice president of the company.

Interesting News and Notes From Everywhere

World's Record of New Construction, Ships' Performances and Other Matters of Note in the Motorship Field

A well-known English shipbuilding firm is advertising a "Super-Semi-Diesel" marine oil-engine in the British shipping magazines!

The name of the big Diesel-driven tug for the Rhine, described in the February issue of MOTORSHIP is FRANZ HANIEL XXVIII.

Prince Valdemar of Denmark, brother of Queen Alexandra of England, recently arrived at San Pedro, California, on his first visit to the United States, aboard the East Asiatic Co.'s motorship PERU.

A telegraph and telephone cable laying and repair motor-vessel has been constructed for the Dutch Government. A Van Berkel oil-engine is being installed.

A motor-ferry will be constructed under the supervision of the Corbin Specialty Co., South Hero, Vermont, and two 150 h.p. oil-engines will be installed. The boat must be in service by June next.

J. Murray Watts, naval architect of Philadelphia, reports that he has placed a contract with the Rancocas Construction Co., of Delanco, N. J., for a 50 ft. motor-tug to be equipped with a three-cylinder Mianus Diesel-engine of 60 h.p.

On office and show room has been opened by the Atlas-Imperial Engine Co. of Oakland, Cal., at 115 Broad Street, New York City. A full line of spare parts will be carried, as well as marine and stationary type oil-engines in small sizes.

It is reported that orders for four 10,000 tons single screw, 3,000 h.p. Diesel-driven vessels have been received by Wm. Doxford & Sons of Sunderland, England, from British shipowners.

It is the intention of the Euskalduna Company, Bilbao, Spain, to equip one of the two cargo vessels now under construction in their yards with a Diesel engine.

Two 45 b.h.p. Kromhout oil-engines have been installed in the new motor lifeboat BRANDARIS owned by the Noord und Zuidhollandsche Redding My, launched on Dec. 3rd last at Amsterdam, Holland.

We hear that a Diesel-driven motor-liner of 20 knots speed, and bigger than the one now building for the Union Steamship Co. of New Zealand, will shortly be ordered from a shipbuilding company in Glasgow.

LA PLAYA, LA MARCA, and LE PERIAL are names of the three new Diesel-electric motorships now completing at Cammellaird's to the order of the United Fruit Company of Boston. The first has been launched.

L. V. Armstrong of the Ingersoll-Rand Co. gave a talk on "Diesel Engines As Applied to the Shipping Industry" before a joint meeting of the marine and stationary Diesel divisions of the Ocean Association of Marine Engineers, New York, on Feb. 1st.

Advantages of Diesel-Driven Motorships Compared with Oil-Fired and Coal-Burning Steamers

1—10% to 12% gain in cargo capacity.
2—Very large reduction in fuel bill.
3—Equal constructional cost per ton of net-cargo carried compared with steamer.
4—Absence of stand-by charges in port, and greatly reduced port fuel-consumption.
5—Greatly increased cruising radius.
6—Less frequent bunkering, allowing fuel to be bought where oil is the cheapest.
7—Elimination of unruly-firemen worries.
8—Reduced engine-room staff.
9—Revolutions of propellers are constant, and not dependent upon moods, and energies of stokers, changes of watch, etc.
10—Propellers do not race in heavy weather.
11—Better propulsive efficiency when ship is in ballast if ship has twin screws.
12—Better average speed over long periods, due to constant propeller speed.
13—Have about 30% special emergency reserve power over normal compared with about 10% to 15% with steam.
14—Smaller wage and food bills due to absence of firemen.
15—Engines always ready for instant start from cold.
16—Very rapid maneuvering—"full ahead" to "full astern" in five to twelve seconds.
17—Waste exhaust-gases can be used for economically operating part of auxiliaries, including steering-gear, or for heating fuel-oil and for cooking.
18—Dispensation of steam-piping on deck.
19—Better conditions for engineers.
20—More rapid handling of cargo, effecting shorter stay in port.
21—Deep-tank can always be used for dry or oil cargo, thus increasing earning powers on both long and short voyages.
22—Hulls can be made smaller, but still carry as much cargo as larger steamers, thus reducing first cost to equal that of steam.
23—Oil in double-bottoms adds several years to life of ship, there also being no heat from boilers.
24—Depreciation can be spread over twenty years, due to not requiring re-boilering after ten years' service.
25—Low maintenance and repair charges.
26—Reliability now betters that of steam-machinery.
27—Saving of tug-charges in port due to rapid handling.
28—No cleaning grate, blowing tubes, ejecting ashes or smoke nuisance.

Two steel oil-barges have been ordered by the Union Oil Co. of California from the Los Angeles Shipbuilding & Dry Dock Co., one 88′ by 34′, the other 106′ by 36′ 6″. Both will have Diesel-driven pumps and a capacity of 3,000 barrels.

So much satisfaction having been given by the Diesel-driven freighter KEDOE of the Rotterdam-Lloyd Line, her owners have decided to equip their next new passenger liner with Sulzer Diesel engines.

The new wooden motorship USTETIND of 540 tons gross has been fitted with a 320 b.h.p. Bolinder oil-engine, by the Tangens Shipbuilding Company of Drammen and delivered to her owners at the same port.

In the SANDE, a new motorship of 580 tons gross, a 320 b.h.p. Bolinder has been installed. She is owned by the A/S Fen Friis & C. O. Lund, of Drammen, and was built by the Svelvik Shipbuilding Co. of Svelvik.

It is reported that a contract for two Diesel-driven ferry vessels of 120′ length has been placed with the St. Helens Shipbuilding Company of St. Helens, Oregon, by the Long Bell Lumber Company, to operate between Long View on the Washington side of the Columbia River and Rainier, Oregon.

Todds Dry Docks, Inc., of Tacoma, Wash., have received the contract to convert the U. S. Bureau of Education's vessel BOXER to Diesel power. The price is $30,000 and the ship is to be completed by April 15th.

The Diesel-engined trawler MARINER was recently sold at Boston by the Court for $5,200. She was purchased by the New London Ship & Engine Co., of Groton, Conn., who will place her on the market.

Two Deutz-Brons 72 b.h.p. oil-engines have been installed in a 300-ton motor-vessel named AMSTEL 8, just launched at Verschure Shipyard, Amsterdam, for service between Amsterdam, Antwerp and Brussels. The owners are the J. H. v. Swiete Steamship Co.

The Inland & Coastwise Service of the U. S. War Department has under consideration its installation of Diesel or Diesel-electric drive in one of the "Natchez" class of twin-screw shallow-draft tow-boats of the Mississippi-Warrior river service as an experiment.

ADOLF VINNEN, a new five-masted auxiliary schooner built at Krupps Germaniawerft, recently ran her trials. She is similar to the auxiliary MAGDALENE VINNEN and of 1,850 gross tons. Her owners are the F. A. Vinnen Company of Bremen. A Krupp Diesel-engine is installed.

WILBO, a motor vessel of 623 gross tons owned by Wilh. Bolstler & Co. of Hamburg, capsized in a severe storm on January 17th near the lightship ELBE I. The WILBO had a cargo of grain destined for Danzig. She was built in 1921 in Tonning. Of her crew of seventeen men, only ten were saved.

The McIver Line's new single-screw 6,000 tons d.w. motorship building at Harland & Wolff's Govan shipyard, will soon run her trials and start on her regular route to South America. A 1,600 i.h.p. Harland & Wolff-B. & W. Diesel engine turning at 90 R.P.M. is being installed.

A 300 h.p. Ingersoll-Rand airless-injection engine of six cylinders, 13" bore by 19" stroke, is being installed in the new steel tug building for the Diamond P Transportation Co. from designs by Edward A. Edwards of Philadelphia. Designs and a complete description of the boat will be published in an early issue.

We greatly regret to record the death of Mr. H. F. Timmerman on January 22nd, following a very short illness. Mr. Timmerman was assistant to Mr. Otto Banner, Chief of the Oil Engine Department of the Falk Corporation, Milwaukee, Wis. He was engaged in oil-engine design for many years, having previously been in the stationary oil-engine department of the old Moore Shipbuilding Co., Elizabethport, N. J.

Club rooms of the Marine Relief Society, Inc., have been opened on two floors at 57-59 Whitehall Street, near South Ferry. This Society has been organized for the benefit of officers and men of the American Merchant Marine. It is purely a social and philanthropic institution supported by nominal dues of members. A free employment bureau has been started.

The motorship ADDA of the Elder-Dempster Line recently completed her round maiden voyage from England to South Africa and return. When the vessel was at Lagos the exhaust-valves of the twin 3,100 i.h.p. Diesel engines were examined and found free from any trace of pitting. There was not an involuntary stop on the voyage, nor adjustment of the machinery of any kind, says the marine superintendent of the Line, who was aboard.

The Deutsche Werft recently delivered to the Hamburg-Amerika Line the new motorship SPREEWALD, this vessel being the first of two twin-screw 8,000 tons cargo motorships built by them. She is 396' long, 53' 3" breadth and 24' 6" depth and is powered with two 1,550 i.h.p. Burmeister & Wain Diesel-engines, which will drive her 11.5 knots. The sister ship, ODENWALD, will shortly be launched and be given trials.

The Grazer Waggon und Maschinen Fabrik A. G. of Graz, Austria, has invented a device for the hydraulic control of oil in Diesel-engines, enabling them to be operated at any desired speed and to be reversed at will. The device is suited to Diesel-engines of ships or for stationary use.

M. M. Davis & Son, shipbuilders of Solomons, Md., have received a contract to build two motor fishing-vessels for Reedville, Va., owners. Each vessel will be equipped with two 200 h.p. Fairbanks Morse oil-engines, and one will be 135 ft., while the other will be 140 ft. long.

Jones & Laughlin Steel Co., Pittsburgh, Pa., have ordered from the Marietta Manufacturing Co., Point Pleasant, W. Va., a steel stern-wheel harbor boat to be used in the Pittsburgh-Aliquippa trade. She will be equipped with a 200 h.p. Fairbanks Morse oil-engine, and will be of the scow type 82' length over all, 64' length on deck, 22' breadth, with 4' loaded draft.

The STANDARD SERVICE, new Diesel-electric tanker for the Standard Oil Co. of California, was launched at the Union Plant of the Bethlehem Shipbuilding Corp. on January 23rd. She was christened by Mrs. A. B. Brooks, wife of one of the directors of the oil company. This Pacific Werkspoor-General Electric propelled tanker was first described and illustrated in the August, 1922, issue of MOTORSHIP, and when completed will be placed in the San Francisco-Alaska trade.

There has just been launched from the yard of John Martinolich, Dockton, Wash., the motor-freighter RUBAIYAT for the Puget Sound Freight Line. She is 65' long, 22' breadth, 10' depth and will be powered with a 75 h.p. Kahlenberg oil-engine, which will drive her 9 knots. One hundred and ten tons of freight will be carried in her daily service in conjunction with the CHACO between Seattle and Olympia. She cost complete about $15,000, and was christened by Leah Jean Lovejoy, daughter of Capt. F. E. Lovejoy, operator of the boat.

A contemporary states that "of the 815 vessels reported by Lloyd's Register to be building at the end of December, 1922, *only* 107 were motorships. (The italics are ours!) Considering that several years ago the percentage of motorships was but 2.4 of the world's tonnage, we think the word "only" is hardly descriptive.

An order has been placed by the Transmarine Corp. with the Hildebrandt shipyard, Kingston, N. Y., for two tugs to be powered with 180 h.p. Nelseco Diesel-engines. These tugs are to be duplicates of the previous craft built last Spring from designs by R. R. Livingston of New York, and they will be 60' by 14' by 7' draft. The success of the former boats on the New York State Barge Canal has led to this new order.

Indication of the activity in small heavy-oil engine installations in Holland is evident from the fact that during the year 1922 there were 272 installations of engines under 100 h.p. each, totaling 5,943 h.p. in boats totaling 17,025 gross tons, an average of 21 h.p. per installation. Eleven installations of larger engines totaling 12,130 h.p. in ships aggregating 16,270 tons were made. Possibly American engine builders can find a market in Holland, as the exchange-rate is nearly normal.

The Pacific Steamship Co. (Admiral Line) will operate the wooden motorships BABINDA, BOOBYALLA, CETHANA, CHALLAMBRA, COOLCHA and CULBURRA between Portland, Ore., and Puget Sound ports and Californian ports. These vessels are owned by the Ocean Motorship Co. of San Francisco, for which company the Pacific Steamship Co. are agents. They total 15,694 gross tons. All are propelled by McIntosh & Seymour Diesel engines, and later on some of these engines will be removed and installed in steel Shipping Board hulls.

Palmers Shipbuilding & Iron Co. of Hebburn-on-Tyne, England, are building a motor-tanker for Tankers, Limited, in which a 3,000 i.h.p. Fullagar Diesel-engine will be installed. They are also building a motorship of similar size for the Ocean S. S. Co., in which a 3,000 i.h.p. Burmeister & Wain Diesel-engine will be installed. The latter vessel is named MEDON.

The United States Coast Guard vessels VAUGHN and CYGAN are each being equipped with two 60 h.p. Fairbanks Morse oil-engines. These craft are the two ex-submarine chasers referred to on page 932 of our issue of December last as having been towed by the cutter SMITH. It was greatly due to the splendid performance of the SMITH's twin oil-engines of similar make and power that these installations are being made.

An Austrian design of Diesel-engine known under the name of "Grazer" is being built by the Italian firm, Stabilimento Tecnico Triestino. Apparently this company also constructs the Burmeister & Wain Diesel engine by arrangement with the company controlling the A. E. G. & Deutsche Werft of Germany. The plant of the Grazer Co. is at Graz, Austria.

Another order for two motorships for service between Hamburg and St. Petersburg and via the Morien Canal to the Volga River and Caspian Sea, has been secured by the Deutsche Werke of Rustringen, Kiel. The new motorships will carry out this service in much shorter time than the German steamer which made the trip last summer. They will be of 1,000 tons d.w.c. and propelled by a Deutsche Werke Diesel-engine of 600 shaft h.p. They will be classed by the German Lloyd and will be ready this summer.

ACTIVITY ON THE WEST COAST BY THE ENTERPRISE CO.

The Enterprise Engine Company is extremely busy on San Francisco Bay installing new Diesel engines in different craft, at the present time having seven installations to take care of in the following boats:

A 165 h.p. four-cylinder engine for the Coos Bay Lumber Co. in their new tow-boat built by Nunes Bros., Sacramento, Cal.

A 135 h.p. four-cylinder engine in the tug YANKEE owned by the American Dredging Co., San Francisco, replacing a 125 h.p. distillate engine. This engine is being installed at Munder Bros. marine ways.

A 100 h.p., three-cylinder engine in the freighter L. SCATENA, which was built by Madden Bros., Sausalito, Cal., for the L. Scatena & Co. & A. Galli Fruit Co., Consolidated. This boat will operate between San Francisco and up-river points, carrying fruit and produce for the markets. The engine is being installed at Madden Bros.' boat shop, where the hull was built.

A 125 h.p., three-cylinder engine, owned by the Wilder Launch Co., to be installed in the tug boat JIM WILDER No. 2, replacing a 110 h.p. distillate engine. This boat is also at Munder Bros. ways for the installation of the equipment.

A 65 h.p., three-cylinder Diesel-engine is also being installed in the freighter LINNEA, owned by Kardassakis Bros., and will be used for up-river trade. This installation is being made at Madden's boat shop.

In addition to the above installations the Enterprise Engine Co. has received an order for a three-cylinder, 125 h.p. engine for Geo. Wallenrod, to be installed in the tug VERA. This order is very gratifying, as it is the third repeat order from the Wallenrod Company after the first Enterprise engine was installed in the TILLY W., the second being in the MYRTLE.

A 100 h.p., 3-cylinder engine to be installed in the schooner KODIAK for Mr. Ole Larsen, Seattle, Washington.

PROSPECTS FOR DIESEL-ENGINES FOR GREAT LAKE BARGES

By A. C. Jackson, Detroit, Mich.

On the Great Lakes there are many barges, the construction of which renders them suitable for conversion to Diesel power. Last December a prominent Canadian shipowner, namely, James Playfair President of the Great Lakes Transportation Co., Ltd., and the Glen Steamship Co., purchased a steel tow-barge, G. E. HARTNELL, and will shortly spend from $150,000 to $170,000 to convert her to a steamer. This type of barge has 5,500 tons cargo capacity with 352′ keel length; 42′ breadth, and 27′ depth. Seven steel barges of this size are also owned by the Pittsburg Steamship Co. of Cleveland.

Another example, two steam-driven tow-barges are owned by Charles S. Neff, 1598 Lake Drive, Milwaukee, Wis., who sold the engines because of their high value. His barge LIBERTY, classed for grain carrying, is of composite construction and carries 800 tons of cargo, length 234′ by 36′ by 13′. James Davidson, of Bay City, and Syd. C. McLouth, Marine City, Mich., have their own dry docks and shipyards and operate several ships. The five Davidson barges are the largest wooden boats on the lakes, being of 4,900 tons cargo, 2,722 gross tonnage, 342′ keel and 46′ beam.

Other firms who own barges of various sizes are the General Transit Co., Leader-News Building, Cleveland, Ohio; C. W. Bryson, manager; John E. Russell, Harbor Building, Toronto, Ont.; Canada Steamship Lines, Ltd.; Montreal, Hamilton Transportation Co.; Montreal, Sincenness McNaughton Line, Common Street, Montreal; M. A. Hanna & Co.; Mr. Wm. Schaufele, Leader-News Building, Cleveland, Ohio.

Diesel-engine builders should start an active campaign with these firms with a view to inducing them to install oil-engines in these barges. A good commercial speed is 10 to 12 miles per hour loaded, and 12 miles light. Such a vessel is underway most of the time, being only in port 20 hours of the week on an average.

M. S. "MALIA" TO HAVE LARGER ENGINES

On page 34 of our January issue it was announced that new engines were to be installed in the MALIA.

It will be remembered that the Cammellaird-Fullagar engine installed on the M.S. FULLAGAR was later on installed in the M.S. MALIA together with another of the same size. After a number of successful trips it was decided to change the propellers in order to approach the designed engine-speed more closely than had been found possible. The change proved not very satisfactory and it was considered that the power was inadequate for the size of the vessel.

It is now proposed to remove the two engines and replace them by twin 1,000 shaft h.p. units running at the designed speed of 120 revolutions per minute. This will make it possible for the speed of the ship to be raised from about seven knots to over ten knots, and retain a practical mean-effective pressure on the engines.

The two engines to be installed are of the four-cylinder opposed-piston two-cycle Cammellaird-Fullagar type, and the dimensions are 18½″ dia. x 25″ stroke. The starboard engine has undergone some very extended trials and full particulars of the independent test by Profesesor W. H. Watkinson have already been published in this magazine. Having thus one of the most complete records of test-bed trials available, it will be very instructive to compare this with the observations which will become possible during the sea trials. It will also be possible to compare the interesting results which were obtained during the three days trial under artificial tropical conditions with a corresponding set of test results obtained under actual tropical conditions.

THE BEAUME SCALE FOR FUEL OILS

In this country the term Beaumè has been standardized for signifying grades of fuel-oils, whereas in Great Britain the term specific-gravity is more generally used. In the December issue of *The Lamp*, the house-organ of the Standard Oil Co. of N. J., the following definition of the term Beaumè is given:

The Beaumè scale so generally used in the oil business was devised in 1768 by Antoine Beaumè, who used the same general system for developing two distinct scales, one for liquids heavier than water and the other for those lighter than water. To illustrate, 60° B. sulphuric acid is heavier than water, while 60° gasoline is lighter, the two being represented on the Beaumè heavy and light scales, respectively.

The Beaumè light scale was worked out as follows: a 10 per cent. solution of common salt was prepared and a hydrometer allowed to sink in it. The point on the glass at the top of the solution was designated as zero. The mark to which the hydrometer sank in pure water was designated as 10°. The scale was then extended on the basis of the degree, each representing one-tenth of the difference between the marks for the salt solution and the water. Obviously, any liquid lighter than water has Beaumè gravity greater than 10°.

This, in fact, is the Beaumè hydrometer now used to test the gravity of oil. The lower the instrument sinks in the oil the lighter the oil. As already stated, distilled water registers 10° Beaumè, while fuel oil may range as high as 20°, refined oils around 42° and gasoline around 60° or more.

NEW BOOK ON DIESEL-ENGINES

In an endeavor to spread further knowledge of the Diesel-engine the Institute of Marine Engineers, London, is now publishing in one volume various papers on the internal-combustion engine which have been read before the Institute during the past three years, eighteen in number, as follows:

Oils for Internal Combustion Engines, by J. L. Chaloner.

Testing of Oils for Internal Combustion, by Thos. McKenzie, A.I.C., F.C.S., M.Inst. P.T.

The Development of the Internal Combustion Engine, by Chas. Baxter.

Notes on the Care and Maintenance of the Internal Combustion Engine, by David P. Peel.

Practical Notes on the Installation and Running of Petrol, Petrol-Paraffin and Semi-Diesel Engines, by Lieut.-Col. D. P. Lamb.

Installation of Marine Oil Engines, by Walter Pollock.

Scheme of Operation in Petrol and Semi-Diesel Type Engines, Forms of Scavenging, Operations of Valves, Fuel Pumps and Ignition, by A. W. Bradbury.

The Lubrication of Diesel and Semi-Diesel Engines, by Edmund G. Warne.

Notes on the Management of Marine Diesel Engine Installations, by Homer McCririck.

Reversing of Marine Oil Engines, by Walter Pollock.

The Open-Fronted Surface Ignition Engine, by F. G. Butt-Gow.

The Marine Diesel Engine: Its Reliability in Service, by Andrew J. Brown.

The Solid Injection Engine, by Chas. McTaminey.

Some Observations on Marine Oil Engines, by D. M. Shannon.

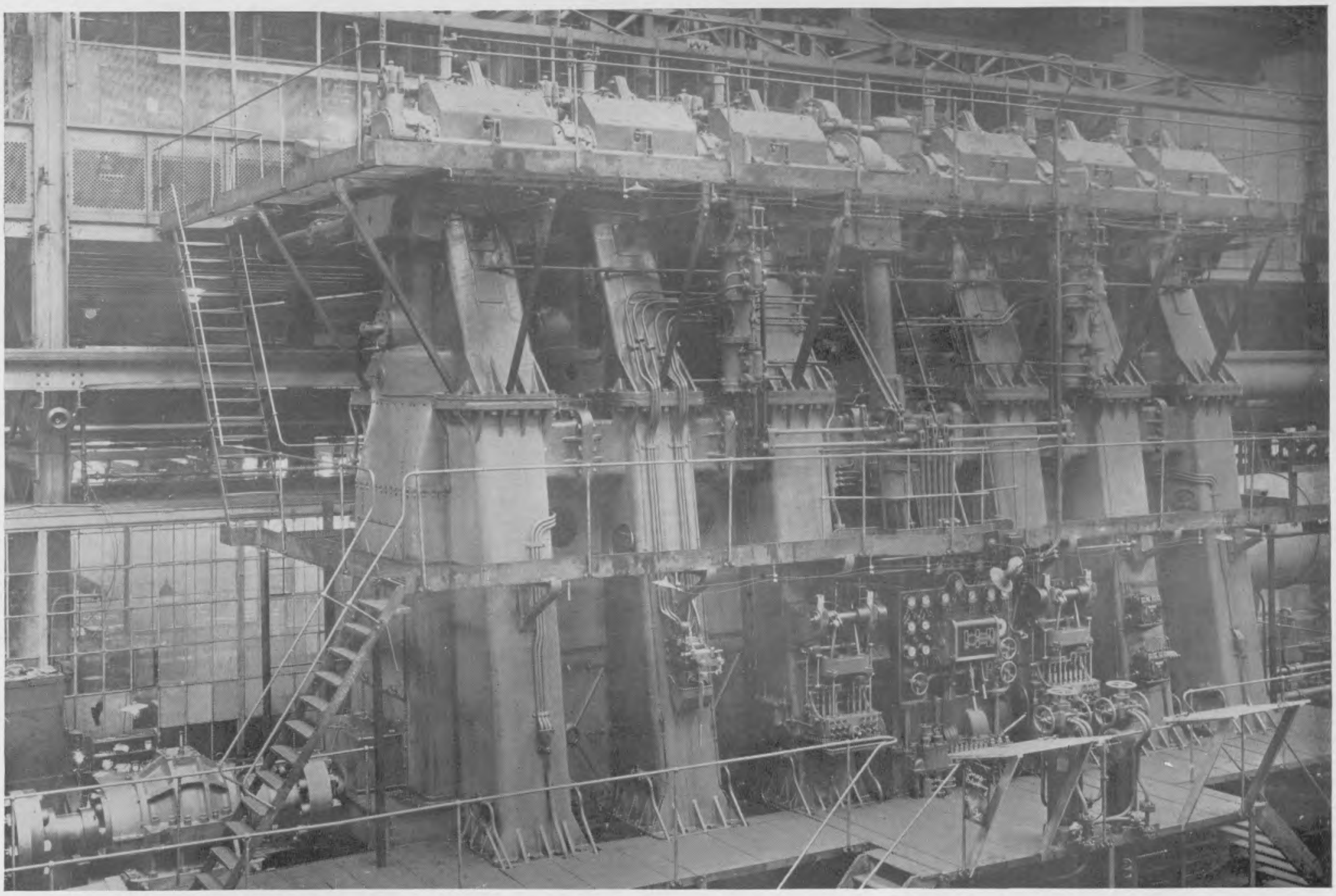
Auxiliary Machinery of Oil Engined Vessels, by Walter Pollock.

Types of Large Marine Oil Engines, by D. R. Hutchison.

*Internal Combustion Engines, by C. N. Hunter.

Marine Diesel Engines. Running Conditions and Operating Symptoms, by A. J. Brown.

* Read before Lloyd's Register Staff Association and included by permission.



An 1,800 S. H. P. Vulcan-Augsburg Engine

For a Single-Screw 6500-Ton Ship of the North German Lloyd

OF larger dimensions and greater power than the Augsburg engine described in MOTORSHIP last October, the new Vulcan engine here illustrated varies also in a few interesting details, which reflect the influence of the marine engineers of the Vulcan Works, Hamburg, Germany. As we stated in our October issue, the Augsburg 4-cycle marine engine was designed by the M. A. N. in collaboration with Blohm & Voss, the Vulcan Works and the Weser Works. The three last-named contributing the marine experience.

In comparing the illustration of the Vulcan-Augsburg engine in this issue with the illustration of the M. A. N.-Augsburg engine in our October number, allowance must be made for the stripping of the ladders, gratings and handrails from the latter engine before the photograph was taken. Apart from this, however, the Vulcan engine shows more gear on the front, first because the fuel-pumps have been brought forward into a position where they are directly under the engineer's eyes; secondly, because the starting mechanism of the forward three cylinders is independent of that for the after half of the engine, and, thirdly, because of the transfer of the camshaft drive from the after end of the engine to the middle.

A diagram of the operation of the reversing mechanism reproduced herewith shows how simple it is. There are separate sets of cams for ahead and astern running. The requisite set being carried into the operating position by means of the longitudinal displacement of the camshaft during an interval when the valve-rockers are in a neutral position, clear of the cams. The "Brown" reversing engine is geared to the fulcrum shaft of the valve rockers at (1) and by means of the bevel pinion (2) and crown bevel (3) brings into play either cam (4) or cam (5) which through a bell-crank arm (6) and a fork and collar (7) shifts the camshaft into the desired position.

Two "Brown" engines are used for the control of the starting-valve mechanism as seen in the diagram. They are linked to separate layshafts for each group of three cylinders respectively and by means of levers and cranks act upon the eccentric collars on which the starting valve rockets are fitted. The main starting-air valve is controlled by a rod connected to one of the layshafts.

With a cylinder diameter of about 29 ins. and a stroke of about 49½ ins. the engine gives about 1,800 shaft h.p. at 100 r.p.m. Fuel consumption is 0.4 lb. per shaft h.p. hr.

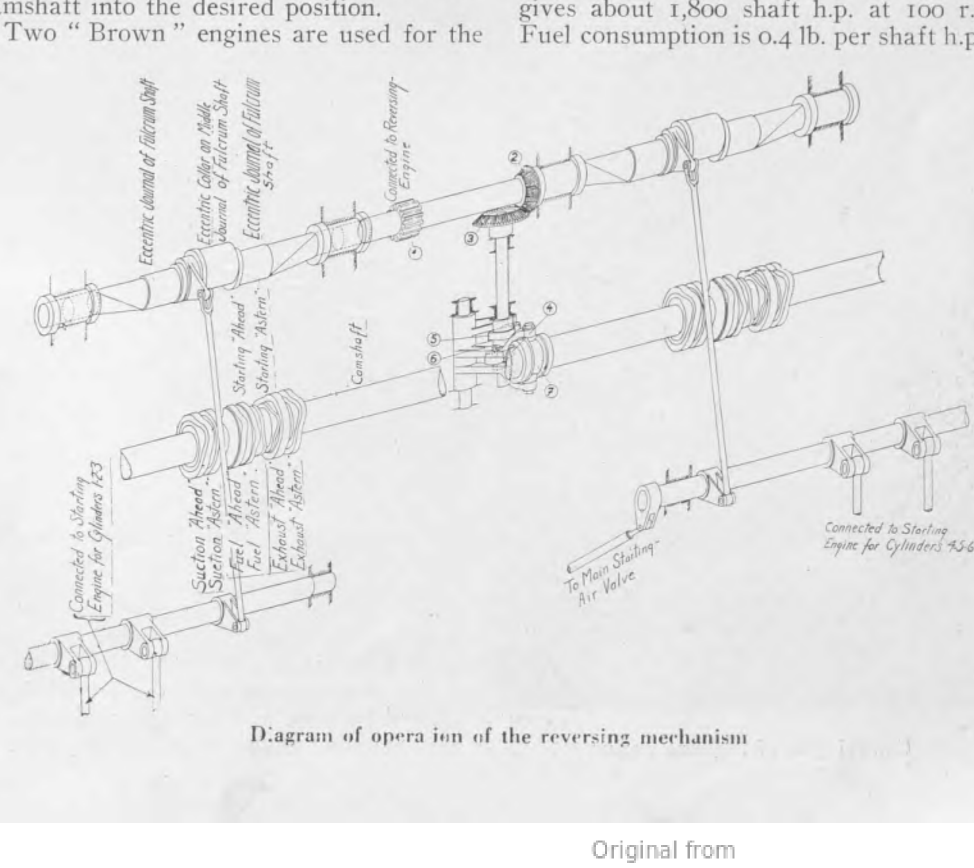


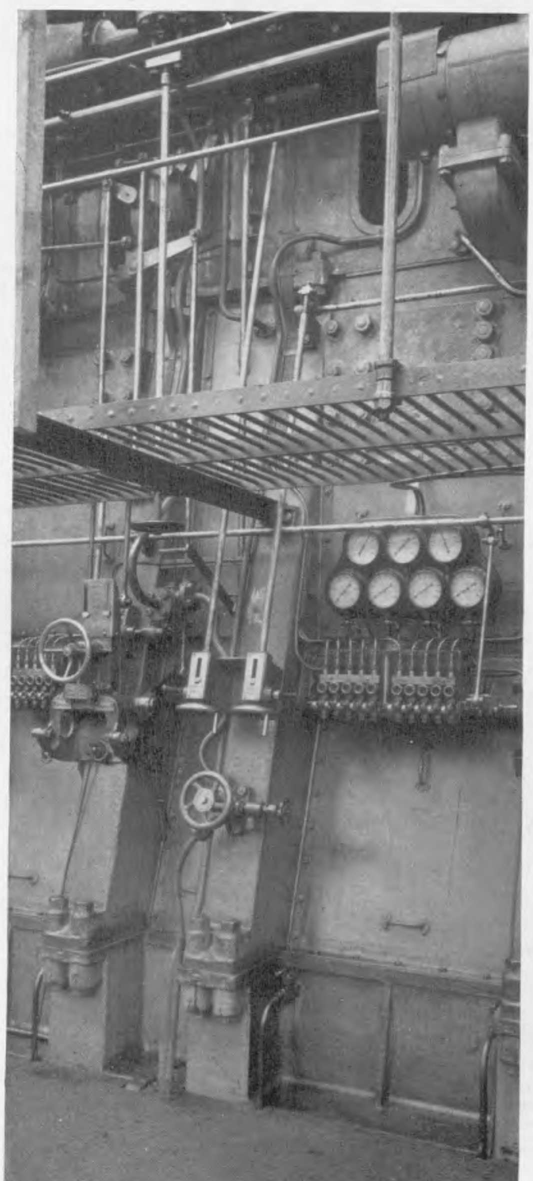
Diagram of opera ion of the reversing mechanism

New Design of Neptune-Polar Two-Cycle-Engine

Swan Hunter & Wigham Richardson Produce Marine Diesel-Engine With Some Novel Construction Features

STUDIES of foreign engine-design whether turbine, reciprocating steam-engine or Diesel oil-motor are always of the greatest value and interest to American engineers and shipowners, and many pointers are often secured which lead the way for the advance of domestic design, or else examples of what not to do in construction can thus be seen and possible pitfalls of a similar nature avoided. Keeping posted on all progress abroad and carefully watching "what the other fellow is doing" never hurt any engineer as yet, when the information has been used in a legitimate manner. Broadminded companies gladly give fully publicity to their designs, knowing that its distribution will assist in general advance of the world's engineering to the betterment of everyone.

With this in mind we endeavor, while continuously furthering the interests of American oil-engine builders, to record properly all important international marine oil-engine developments in accordance with one of the established policies of this magazine. Without question, articles of this nature published in past issues of MOTORSHIP have been of tremendous value to domestic engineers in the same way that our articles discussing untrammelled American practice have shown European engine-builders that they cannot find on the Eastern Hemisphere all that there is to know about oil-engine construction. Even some of the European Diesel-engine designs purchased by firms in this country have been improved in many ways by designers not tied down to ideas by traditional rules of engineering, while our methods of production often surprise and win the warm admiration of conservative engineers from over the sea.



Control gear of Neptune engine

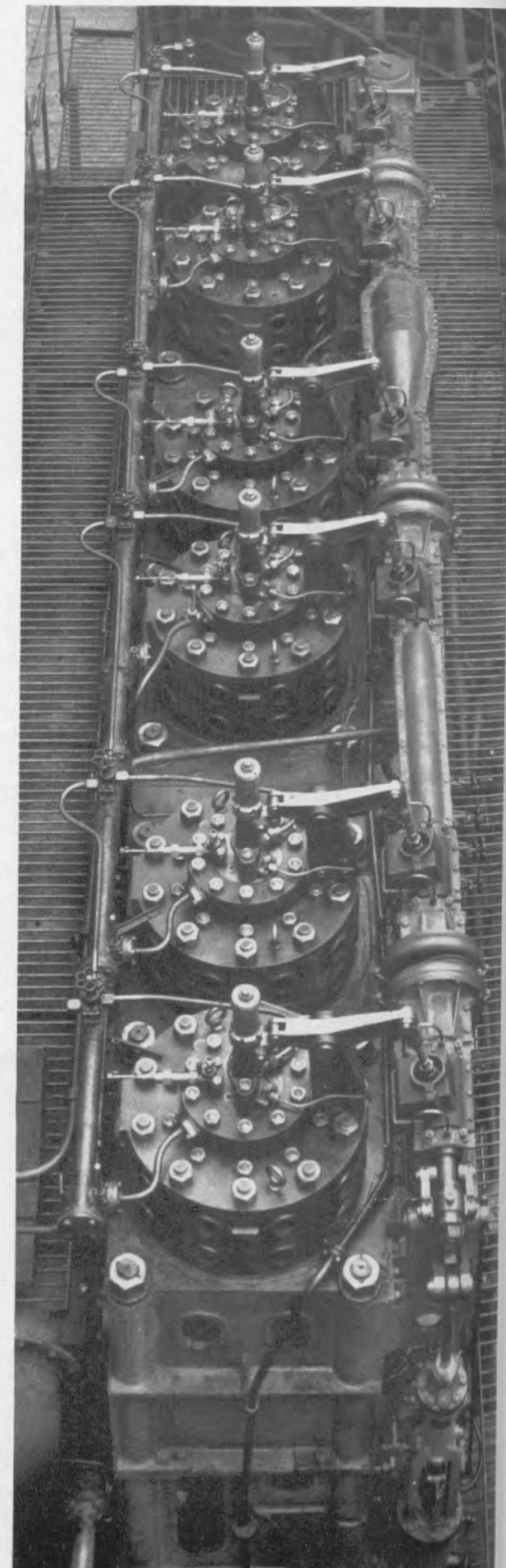
It is very possible that we can gain more than a little knowledge from a study of the leading features of the design of the new Neptune Diesel-type marine engine, such as the novel construction of the cylinder head, which we are enabled to describe and illustrate through the courtesy of Swan, Hunter & Wigham Richardson, Ltd., Newcastle-on-Tyne, England, whose experiences in motorship and oil-engine building extend back a long period, they having built the old Polar-type engined Great Lakes freighters TOILER and CALGARY over ten years ago. A little later they constructed some large sets, of modified Polar design, for the ocean-going ships ARAMIS, ARABIS and ARUM of the Flower Motorship Company's fleet, installed through the enterprise of Fred. & Harry Lane, and Lord Bearstead (Sir Marcus Samuel).

While on the subject of improvements that have been made by some of the American companies who have adopted foreign designs, it is interesting to recall a few remarks which we made at the time of discussing the type engine that Swan-Hunter installed in the ARUM, ARABIS and ARAMIS in our issue of June, 1917. We said: "Whether, or not, a licensee is justified in departing from the licensor's design largely depends upon circumstances, and in some cases the step is a wise one, while in others such action would be extremely doubtful. Where to draw the line is hard to define. In instances licensees are marine steam-engine constructors of considerable experience and repute, and may have acquired a license from a concern building stationary Diesel engines purely for the internal-combustion engine experience, and under these particular circumstances would show wisdom in introducing their own marine steam-engine knowledge, because the licensor would not have proper acquaintance with the exact requirements of mercantile work. On the other hand if the licensor previously has had very extensive experience with large ocean-going Diesel-driven motorships the licensees probably would make a bad break if they departed from what it had heavily cost the licensor to learn."

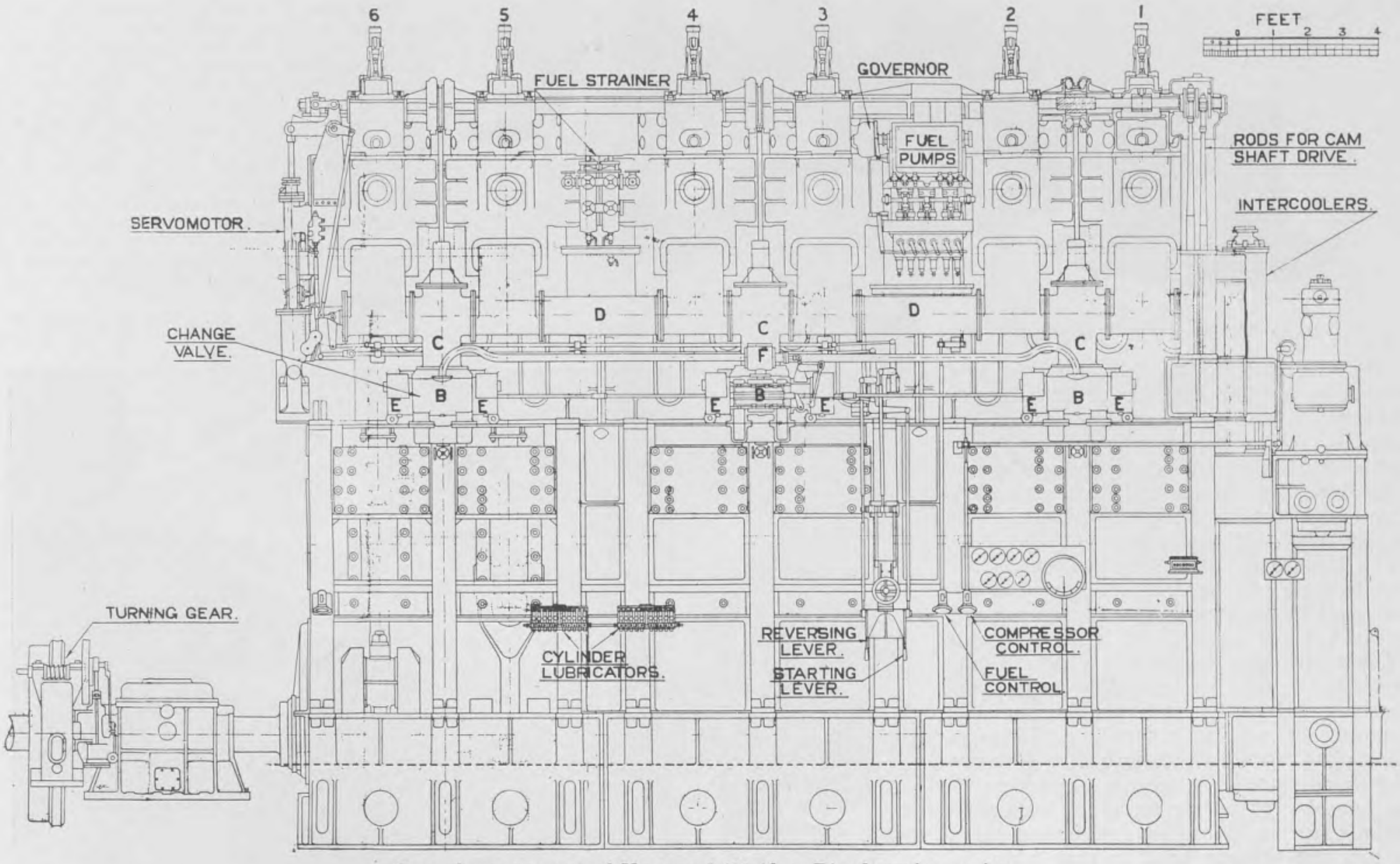
One other factor which we should have added on that occasion, and which has just as much bearing on the question, is that it is often necessary for American firms to make modifications in accordance with the particular requirements of American ships, operators and shop practices, and in the same way British concerns usually must modify Continental-European design to their own special ideas.

As is consistent with the knowledge acquired by time and experience further improvements have been made with the Neptune design, and such have been incorporated in the engine recently built for the tanker ARNUS, to the order of the Cia. Generale de Tabacos de Filipines, and interesting comparisons can be made with the cross section of the older engine which we also reproduce. The latest model is a six-cylinder engine of the stepped-piston design developing 1,400 i.h.p. at about 125 r.p.m., with cylinders 17 in. bore by 35 in. stroke. Two are installed in the ARNUS.

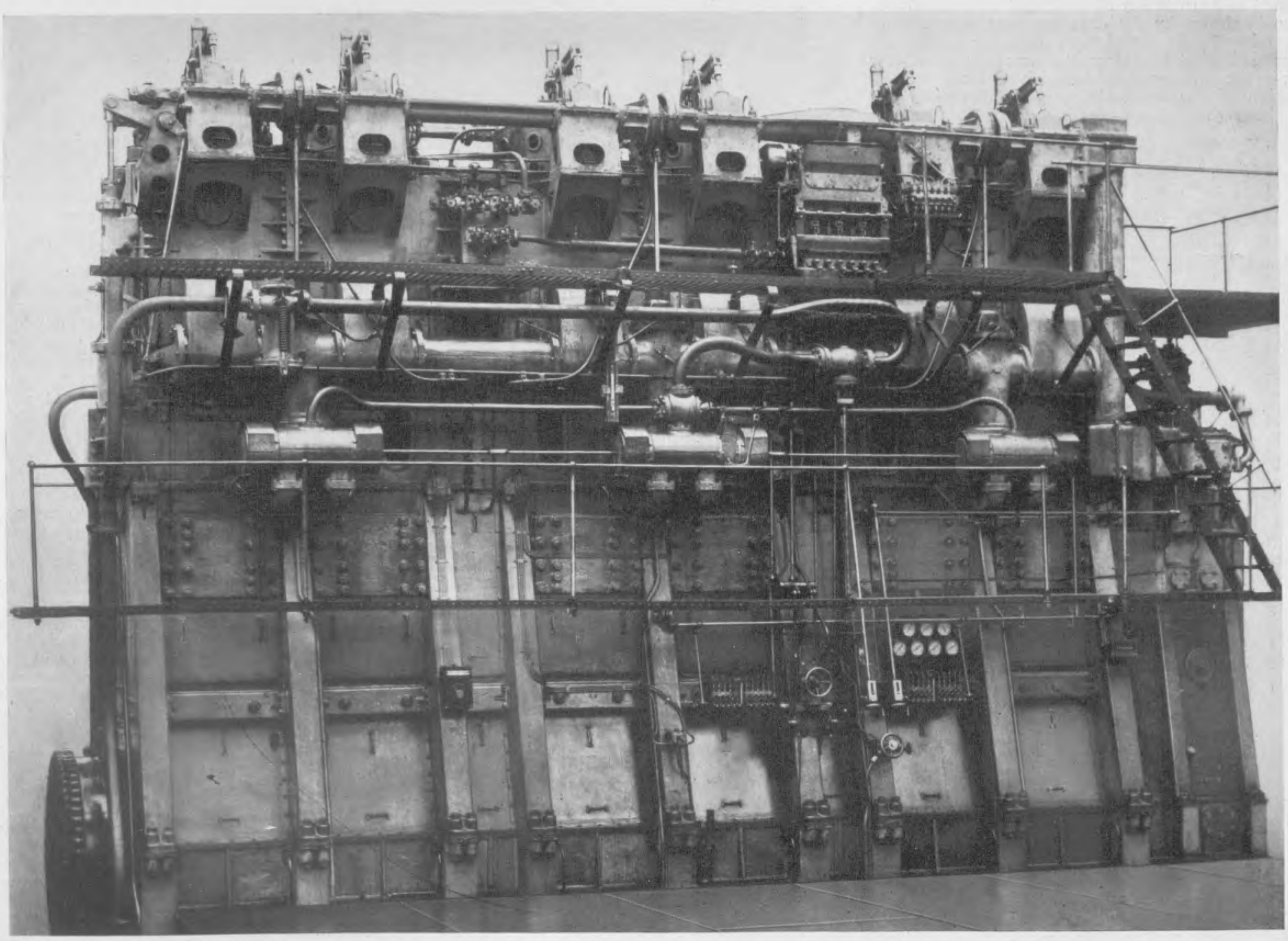
The old ARUM engine model had four stepped-pistons 16⅛ ins. bore by 33⅞ in. stroke, and had an output of 850 i.h.p. at 123 r.p.m. and an m.e.p. of 102 lbs., while the fuel-consumption was 0.47 lb. per shaft h.p. hour.



View of cylinder heads and valve gear of Neptune engine



General arrangement of Neptune 1,400 i.h.p. Diesel marine engine



The new 1,400 i.h.p. Neptune two-cycle Diesel marine engine, one of two installed in the Spanish tanker "Arnus"

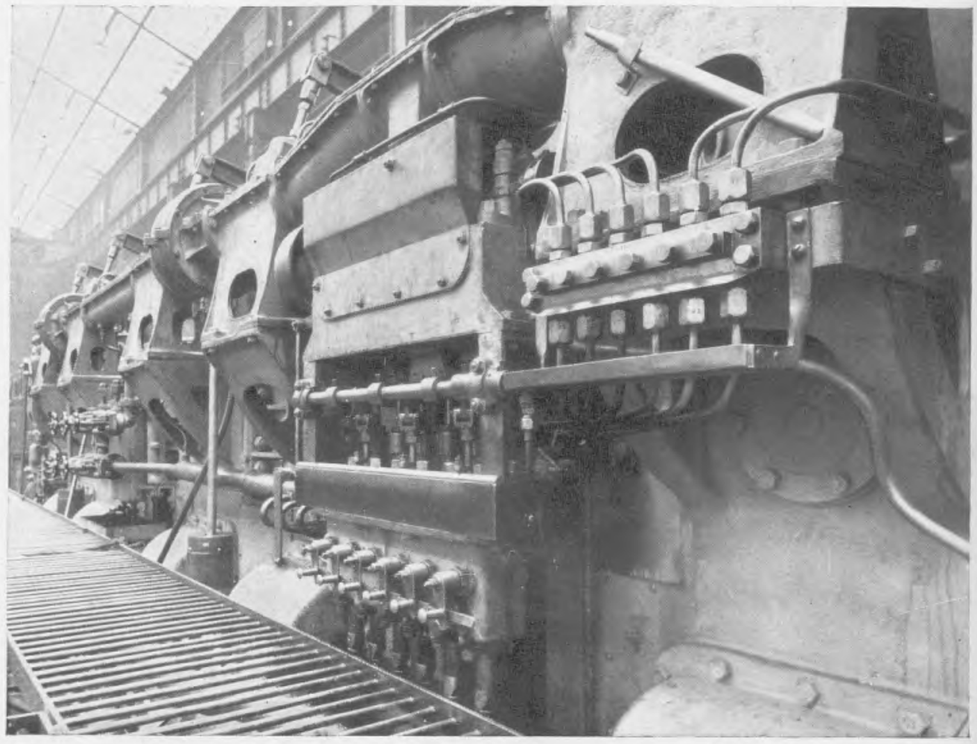
Liners in the cylinder-heads, a new feature of construction introduced in the Neptune design

Each pair of cylinders is supported by three cast-iron columns at the front, which are arranged to carry the crosshead-guide plates, and three cast-iron columns at the back, which are bolted to the front columns. The columns are secured to the bedplate and scavenging cylinders, and continuous bolts connect the working cylinders to the bedplate. As is common practice with large slow-speed engines the crank-shaft is of the built-up pattern, with two cranks in each section, two cylinders thus forming one unit, allowing this type of engine to be built with two, four, six, eight, or more cylinders. The working cylinders are fitted with a separate liner, in which are arranged the scavenging and exhaust ports.

A special feature of the Neptune engine is that the valve mechanism controlling the admission

As will be noted, the height of the new engine is greater than usual with marine oil-engines, due to the stepped-piston design in which the scavenge piston and chamber are directly below the combustion cylinders. But the makers are also developing an alternative design for vessels with which height of engine is a consideration; with this model the scavenge-pumps are not beneath the working-cylinder, but are actuated by rocking-levers, thus producing a much lower engine. A Neptune engine of this particular design was illustrated and described in our issue of May, 1920, and was unusual in that it had light cast-steel frames. It was of 1,500 i.h.p. Also in December, 1919, we described a Neptune engine of 1,500 i.h.p. from six-cylinders 18 in. bore by 37 in. stroke which contained some other variations in design, but think it was not actually built in that form.

The new Neptune marine oil-engine, known as type "A," is designed and built under license from the Atlas Diesel Co., Stockholm. It is of the reversible, single-acting crosshead type, designed to burn heavy-oil fuel, and its general design is shown by the drawings and photographs reproduced. As stated the scavenging-pumps are arranged directly below the working cylinders, while the air-compressor is driven from an extension of the crank-shaft, at the forward end of the engine.



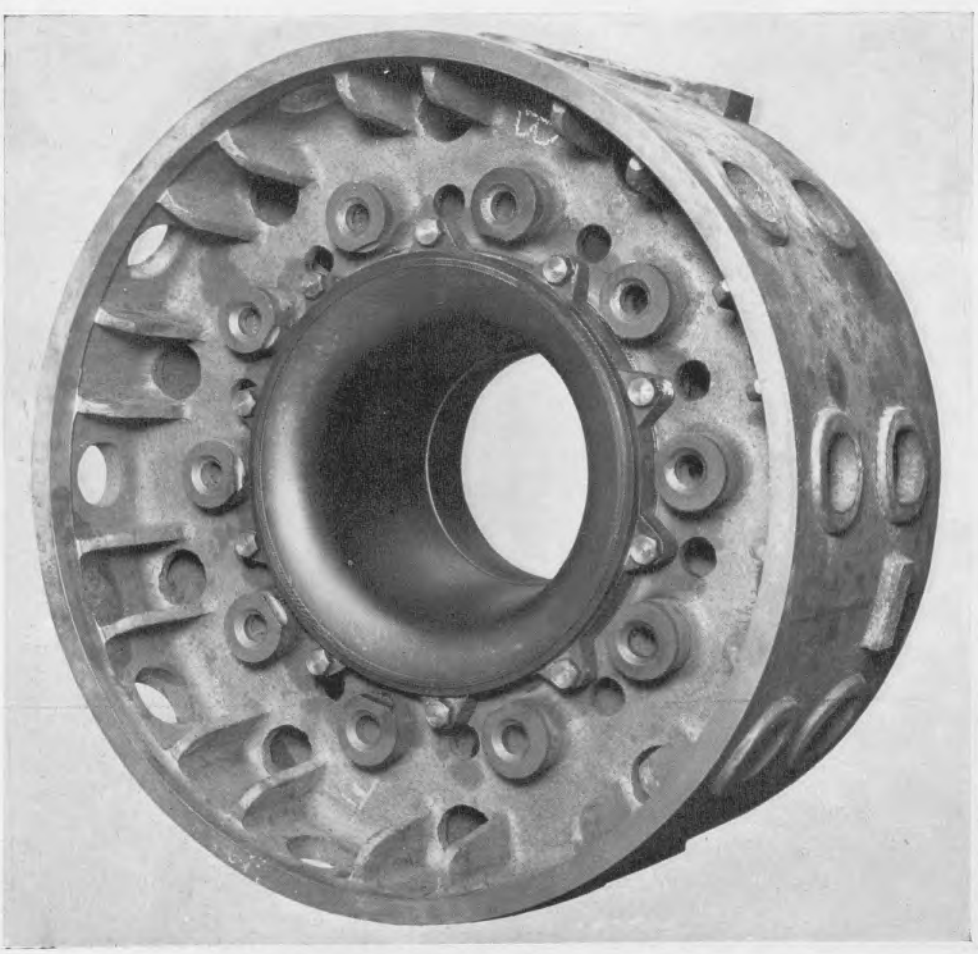
Fuel pump of Neptune oil-engine

and discharge of the scavenging-air to the scavenging cylinders is also adapted to control the admission and discharge of the compressed air for starting the engine, an arrangement which greatly simplifies the starting mechanism, and which has proved successful in previous engines of this make. The arrangement of the valve gear is clearly indicated on the drawings of the cross section and general arrangement. The main parts of each set of the valve gear consist of the piston-valve A, which controls the direct passage of the scavenging-air or of the compressed-air for starting, as the case may be, to and from the scavenging cylinders through ports in the scavenging-cylinder walls, and a change valve B which serves to admit either the scavenging-air or the compressed air for starting to the piston-valve A as may be desired.

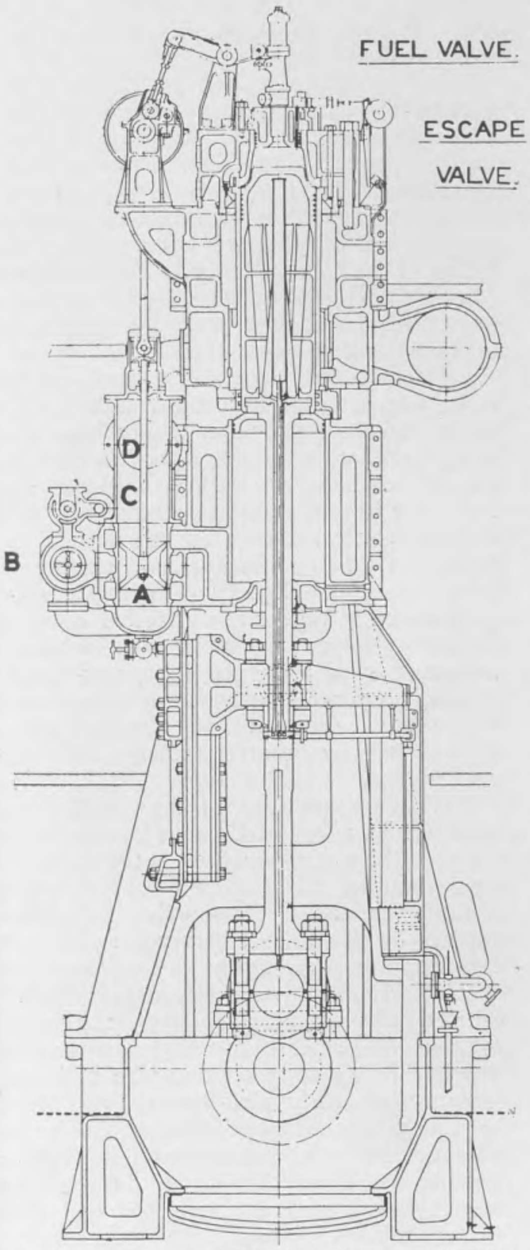
The piston-valve A is actuated by an eccentric on the cam-shaft, the eccentric being set by an axial movement of the cam-shaft to the required position for driving the engine in the desired direction. Changing of the cams on the cam-shaft and the setting of the eccentric for the valve gear are thus effected in a single operation by imparting an axial movement to the cam-shaft. One set of valve gear is provided for each pair of cylinder units, the cranks of each unit being arranged 180 degrees apart for this reason. Above the piston-valve A is arranged an air receiver, consisting of a vertical pipe C and a horizontal pipe D from which the scavenging-air passes to the working cylinders.

Atmospheric air for scavenging purposes is admitted to the change valve B through the inlet ports E. E., while compressed air for starting is admitted through the compressed-air valve F. The change valves B are placed in the desired position by means of a lever worked from the starting platform. In order to diminish back pressure or exhaust resistance when starting with compressed air, the change valve B is arranged so that most of the air is exhausted through the ordinary air intake pipes E. E.

When the piston-valve A is below the central



The Neptune cylinder-head with liner in position



Section of the new 1,400 i.h.p. Neptune oil-engine

position, air passes through the bottom row of ports into No. 1, 3 or 5 scavenging cylinder, and at the same time the top row of ports are open and allow No. 2, 4 or 6 scavenging cylinder to discharge into the receiver C. When the piston-valve A is above the central position, No. 2, 4 or 6 scavenging cylinder is taking in air through the top ports, and No. 1, 3 or 5 scavenging cylinder is discharging into the receiver C through the bottom ports.

The rotating motion of the cam-shaft is transmitted from the crank-shaft by means of eccentrics, rods and counter-shaft, this arrangement of gear being very convenient for adjustment. Each cylinder is provided with a fuel-injection valve situated on the top of the cylinder cover. Each valve is supplied with fuel from a separate fuel-pump, and each pump is arranged with double discharge valves to prevent leakage.

A novel feature has been adopted in connection with the cylinder-heads, as referred to earlier in the article: The main cylinder-head is fitted with a loose liner of symmetrical form having one central orifice at the top arranged to take a small head which is bolted to the top of the main head and which takes the fuel valve. Where the small head fits into the cylinder-head liner, it is provided with rings and the liner can thus expand freely. The bottom of the head liner is shaped to the form of the piston which is also symmetrical. The main cylinder-head is not really exposed to the heat of combustion so a crack is hardly likely to occur. The cylinder-head liner can by this means be cooled very effectively, whilst the main cylinder-head need not be cooled beyond the surface, forming the water space round the liner.

The main working-cylinder liner is separate and is also free to expand. The thickness of metal at the top of this liner has been greatly reduced by the fitting of a sandwich plate which holds the liner in position.

By this method of construction it would seem that engines of large cylinder diameter may be built without undue risk of trouble arising from excessive heat stresses in the head or cylinder liner.

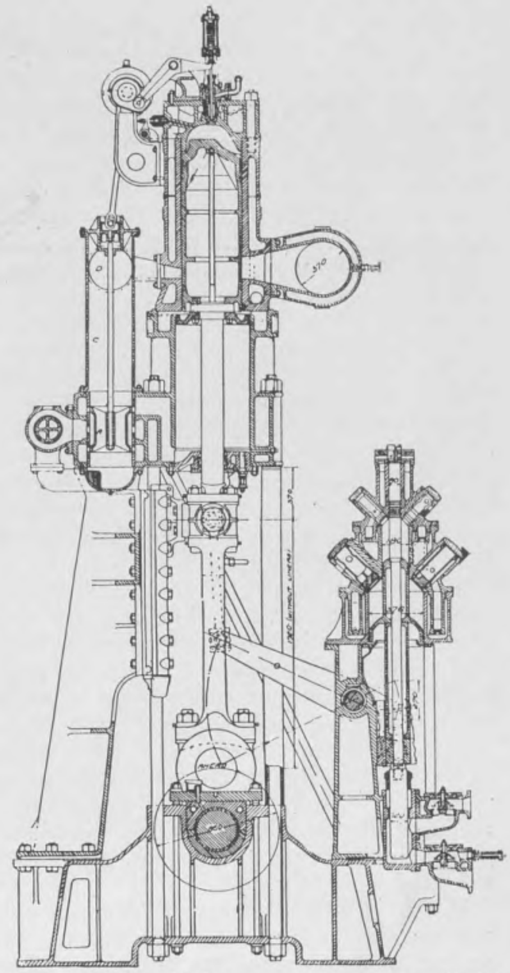
The fuel pumps, which are driven through gearing from the cam-shaft, are arranged so that they are out of action during the operation of reversing, and to remain so until the engine is rotating in the desired direction, when they are automatically brought into action again, thus avoiding excessive pressure in the cylinder during this operation. The suction-valves of the fuel pumps are controlled by hand and by a centrifugal governor which is driven from the cam-shaft.

As the starting and scavenging air is led through ports, the fuel-injection valve and the relief valve are the only valves placed on the top of the cylinders, and the number of small working parts is therefore much reduced.

Sea water is used for piston cooling, the water entering and leaving the piston through telescopic-tubes by way of the hollow piston-rod, large air vessels being provided to prevent water hammer.

The hand gear for controlling the engine is arranged so that one man can carry out the necessary operation, while the necessary pressure gauges and revolution counter are arranged in a suitable position.

For manoeuvring, the cam-shaft is moved in a horizontal direction by a servomotor located on the after end of the engine, which is operated from the hand controlling gear. There are four cams in all for each fuel valve—two for full power, one ahead and one astern and two smaller cams, one ahead and one astern, the latter being arranged for slow running.



Section of the old Neptune engine as installed in the "Arum," Arabis, etc.

The air compressor is of the single-acting three-stage cross-head type. The h.p. cylinder is fitted with a loose liner, while the other cylinder liners are cast with their water jackets.

The intercoolers, which are of the vertical tube type, are located at the forward end of the engine and are fitted with separators on each stage.

The engine is totally enclosed, forced lubrication being provided throughout. A sight-feed lubricator, is provided for lubricating the working and compressor cylinders.

New motorships "Titania" and "Spreewald" fitting out at the Deutsche Werft, Hamburg. Both have A.E.G.-B&W. Diesel engines installed

Maneuvering of Motorships in Harbor

An Impartial Investigation of the Subject Made by an Ex-Steamship Navigating Officer

IN the furtherance of the policy of MOTORSHIP, the development and exploitation of the oil-engined vessel as the ideal means of present and future ocean transportation, there are constantly appearing articles dealing with proposed or actual marine oil-engine installations. There was a time less than a decade ago when this type of marine power was so little known that very few practical shipping men, especially in America, had given it serious thought. The transition has been startling. Like so many others of the century's wonders this infant prodigy has fairly leaped into its place of pre-eminence. And the going has not always been an easy road, in spite of the speed with which it has reached the top. It is not easy going today.

The articles just referred to have shown conclusively time after time and for ship after ship the immense economy in time, fuel weight, cargo space and general practicability. Columns of irrefutable statistics taken from actual performance have been arrayed for the eyes of the interested as well as the skeptical,—and the latter are numerous. Many engine and ship builders realizing the enviable future of the oil-engine have hastened to broaden their fields to include this type.

But it is still a continual fight not only against ignorance and skepticism, but against steam engineering and allied interests. Then, too, many of the motorship companies operating successful units have placed the seal of "confidential" on all data concerning their operation. Much valuable information is thus closed to the shipping public, but there has been enough already published in MOTORSHIP's pages to forecast the trend that is already setting in toward accomplishment of our purpose.

The writer—who for several years was a navigating officer on steamships — is intimately acquainted with men in the operating departments of several large companies operating motorships. In fact, one of his friends is directly engaged in engineering-efficiency work and has devoted a great deal of his time to a comparative study of economies of the various working units of the fleet. This man is enthusiastic in his admiration of the Diesel-propelled ship; but when asked for figures covering some of his studies he was regretfully compelled to refuse, due to the strictly "secretive" policy of the company. These people as well as others have found the operation of Diesel-driven vessels so advantageous that they are keeping the information to themselves, going ahead acquiring more of that kind of tonnage and quietly getting a long start of some of their less wide-awake competitors.

The information that they are keeping to themselves would of course prove very valuable to the industry as a whole if it were allowed to appear in print, but as stated before, MOTORSHIP publishes such preponderantly convincing evidence of the superiority of the oil-engine as a marine propulsion unit that it is hardly creditable that there can remain a doubt as to its superiority in every way.

With this thought in view, the writer started out with the idea of getting a few observations on the maneuvering qualities of the motor-driven ship. The American-Hawaiian Lines' CALIFORNIAN happened to be in port so he began his investigations there, this particular company being far from secretive. This fine, 11,200 d.w.t. twin-screw cargo-carrier was very fully described in the June issue of MOTORSHIP, 1922, and in subsequent numbers. It will probably be recalled that the hull was built by the Merchant Shipbuilding Corp. of Chester, Pa., while the engines were constructed and installed by the Wm. Cramp & Sons Ship & Engine Bldg. Co., Phila., Pa. They are twin six-cylinder 29⅛"x45¼" Cramp-Burmeister & Wain Diesel engines of 2,250 I.H.P. each, propelling the ship at a speed of 12 to 13 knots with a fuel-consumption per 24 hours (for all purposes) of 14 tons.

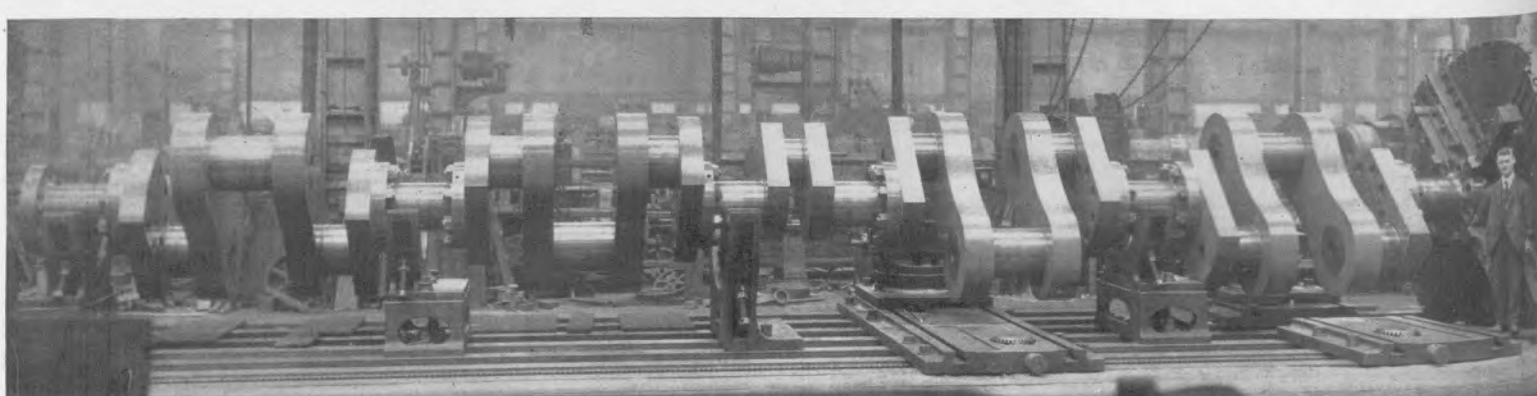
The auxiliary machinery, cargo-winches, warping winches, windlass, etc., are electric driven and the steering gear electro-hydraulic, the Hyde steering engine in the after flat under the poop deck being controlled from the pilot-house by means of the Standard 3" plunger, A. E. Co. telemotor. Electric power is supplied by four Diesel-electric sets of 65 K.W. (75 to 100 b.h.p. each) situated in the engine-room.

Captain Wm. Lyons, the CALIFORNIAN's master and admiral of the fleet, is a man of wide and varied experience. He is now in one of the most satisfactory positions of his career—in command of a vessel of which he is justly proud. The writer, who incidentally has paced the bridges of quite a few ships himself and has a kindred feeling of sympathy for the ship's officer who must keep his post up there under all sorts of conditions and in all kinds of weather, felt a thrill of pleasure upon gaining the bridge of the CALIFORNIAN. For simplicity, comfort and efficiency he has never seen any arrangement on a freighter to beat the bridge layout of the CALIFORNIAN.

Of course, the wheel is enclosed—in the wheel house. But the usual runway of the bridge, athwartship from wide wing-tip to wing-tip forward of the wheel, is also enclosed. The wings extend well out and there are liberal glassed openings allowing a clear, unobstructed view all around the horizon. Among the modern instruments on bridge is the Sperry Company's latest gyro-steering repeater controlled from a master gyro on the deck below. This instrument is of a rugged type, and is immensely improved through a new invention which has taken-out the vibration complained of by quartermasters with the earlier type.

"What do you think of the way this ship handles?" I asked of Captain Lyons. "She handles like a top"—which is the seaman's encomium of all that is worthy. "But around the docks, maneuvring in narrow places—do you believe that you can handle this vessel as thoroughly and efficiently as you could if she were steam propelled?" The captain is a man thorough in his convictions, and he certainly did know that she handled better than anything he had ever commanded. The pick-up from one speed to full power of another was almost instantaneous in its rapidity and by experience he had found that he could always depend upon his engines to give him just what he wanted.

In maneuvring a large vessel around docks and in narrow channels especially where there is a strong current, tugboats are usually desirable and often amount to quite an expense item in time and money. With this in mind I asked Captain Lyons if he found their use necessary. He looked at me in scorn. "Mister, I never use them—not from one voyage's end to the other and I make some difficult ports all up and down the west coast, Puget Sound and the ports of the Columbia River. If I had my way, there'd never be any tugs. In a word, she handles like a top!" And it seems to me that there is little left to be said. The



In our opinion the leading American forges are giving insufficient attention to publicity for securing the tremendous amount of business being placed for crankshafts, piston and connecting rods, etc. Over a thousand crankshafts are now ordered annually for oil-engines by domestic engine-builders. The above illustration is the crankshaft of a 3,000 i.h.p. Doxford marine oil-engine. Three of these big engines are now being built by the Sun Shipbuilding Co., Chester, Pa.

I next went to Pier 4, Brooklyn, where I visited aboard the M. S. SONGVOND.

This motorship is one of three sister ships, the SONGDAL and SONGVAAR being the other two, owned and operated by the S. O. Stray Steamship Co., N. Y. The February, 1921, issue of MOTORSHIP contained a detailed account of her conversion from steam to Diesel propulsion, together with a history of her operation and statistics concerning operating costs, etc.

She is single-screw. Only the main engine is Diesel, the auxiliary machinery being run by steam, generated in two donkey-boilers, only one of which is required at a time except at certain times in port when all machinery is in operation. This vessel is of 5,000 tons D.W. Her captain is Carl Swensen, Chief-Officer Adler Rostad, and Chief-Engineer Sigval Syvertsen.

In the chief-officer's room I talked for a long time with both the captain and the chief-officer, and I found them high in their loyalty to and praise of the Diesel-driven ship. Their opinions of her handling was a repetition of what I had heard from Captain Lyons of the CALIFORNIAN—yet she is a single-screw vessel! They, too, are men of wide experience and loyal service. Mr. Rostad upon being lead into more intimate talk disclosed for inspection an engraved gold watch presented to him by the S. O. Stray Co., her owners, for heroism and bold seamanship in saving life at sea in a mine explosion in the Mediterranean Sea.

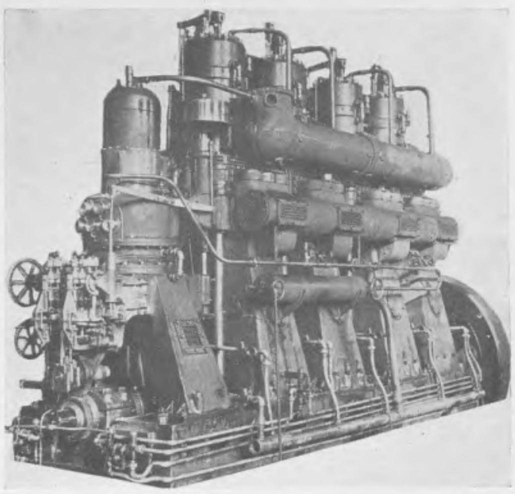
This vessel, during the writer's visit, was loading general cargo, and expected to sail with about 4,300 tons for Rio de Janeiro, Rosario, Sante Fe, and Buenos Aires. Upon her return she will bring a full cargo of grain, hides, etc., to Boston and New York. All in all a voyage in distance equal to half the circumference of the globe and after she takes on fuel in New York just before sailing at the low prices available, she will not refuel again until ready to sail out of New York again on her next voyage. Think of the saving in time, fuel and money! With a fuel capacity of 600 tons, she only burns 7½ tons per day for all purposes and has a cruising radius of perhaps 17,000 nautical miles.

On her last inward bound voyage the SONGVOND left Iquiqui Dec. 13th, with 4,648 tons of nitrate for Philadelphia. And here is where the advisability of Diesel-electric auxiliaries show up. While about 100 miles south of Guantanamo, the second of the two auxiliary boilers began to go bad through collapse of furnace, and under very weak pressure for auxiliaries and steering-engine the ship was forced to put into Guantanamo, where she arrived on Dec. 28th. It took five days to repair this damage—five days detention on account of steam trouble, and not one minute Diesel detention. Yet her Diesel engine is to be numbered among the oldest in service afloat.

This vessel, like her sisters, was fitted with the Diesel propelling engine as an experiment, and in spite of the fact that she still uses the old steam-driven auxiliaries, she has been an eminently successful experiment, so successful in fact that she has been in continuous lucrative operation since the conversion away back in 1914, and was purchased by her present owners at a very high price. A record to be proud of. She carries a crew of but 27 men, apportioned as follows:

Deck	*Engine-Room*	*Steward's Dept.*
Master	Chief-Engineer	Chief-Steward
1st Officer	1st Asst.-Engr.	Cook
2nd Officer	2nd Asst.-Engr.	2nd Cook
3rd Officer	3rd Asst.-Engr.	Messboy
Boatswain	3 Oilers	
Carpenter	3 Firemen	
7 Sailors		
Total:— 13 men	10 men	4 men
Grand Total:—27 officers and men		

Then I went aboard what I believe is the largest Diesel-propelled ship afloat, namely, the Standard Oil tanker ZOPPOT. She is twin-screw Krupp engined and was built in Germany. This huge vessel handles like a yacht, and in a conversation with an experienced shipping man who knows her intimately, I was impressed by his evident enthusiasm. Although he was not at liberty to relaese any statistics for publication, he stated that her change of speed was "lightning-like in rapidity," and characterized her maneuvring ability as "remarkable." From numerous other sources I have received the same encouraging comment and to me it all boils down to that bit of salty commendation by Captain Lyons, "she handles like a top."



The 800 i.h.p. Southwark-Harris two-cycle Diesel-engine

"DOMINION MILLER'S" PERFORMANCE

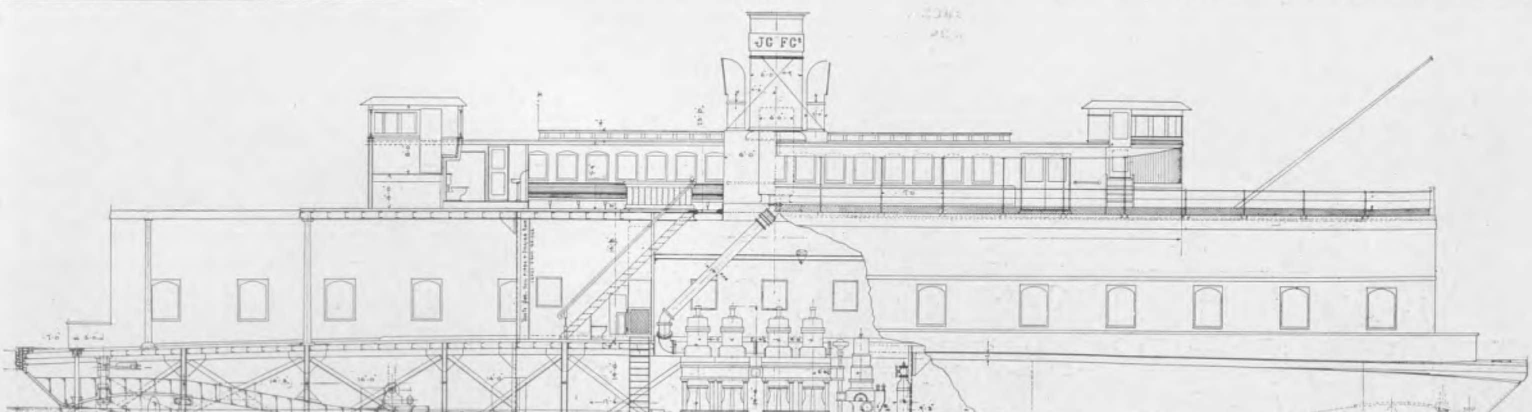
Furness, Withy & Co.'s Doxford opposed-piston engined motorship, DOMINION MILLER, was in New York harbor the first week in February, having crossed to Philadelphia and then run up to this port. This second visit we made aboard gave us opportunity to note the satisfactory service her machinery is giving and to learn of the relative fuel-consumption of her main-engine and steam auxiliaries.

As will be remembered from previous descriptions of this vessel, notably that in the April, 1922, issue, there are for auxiliary power two Cochran donkey-boilers, 16 feet 6 inches high by 8 feet diameter, using steam at 100 lbs. pressure. Only one of these boilers is used at sea, but both are in use at sea. In the latter case the daily fuel-consumption of donkey-boilers for furnishing steam for all auxiliaries is 2¼ tons of 19 degree Beaumé fuel-oil, while for the main-engine 7.95 tons of 22 degree Beaumé oil is used per day, a total of slightly over 10 tons per day for all purposes. Fuel-consumption works out at 0.33 pound per i.h.p. hour.

In addition to the regular staff of 10 engineers and oilers and three firemen for the donkey-boilers the DOMINION MILLER now carries five extra engineers who are training for future service on motorships, a procedure which might well be followed by American motorship owners. Her owners have five more motorships now building, three with Doxford and two with Richardson-Tosi Diesel engines.

HAMBURG-AMERICAN LINE MOTORSHIP "ODENWALD"

ODENWALD, the new motorship of 8,000 tons for the Hamburg-American Line was launched at the Deutsche Werft yard on December 8th. This vessel has been equipped with two A. E. G.-Burmeister & Wain type Diesel engines together aggregating 3,100 shaft h.p. This power will give the vessel a speed of 11 knots on a consumption of 14 tons per 24 hours. The length of the vessel is 400', breadth 54', depth 38'.



Plan of shoal-draft Diesel-ferries designed by Leonard B. Harris for the Jersey Coast Ferry Co., in each of which an 800 i.h.p. Harris Diesel-engine is to be installed. Two boats are contemplated for the South Amboy-Tottenville service, and bids are being obtained, said the owner of the ferry-line when in our office recently

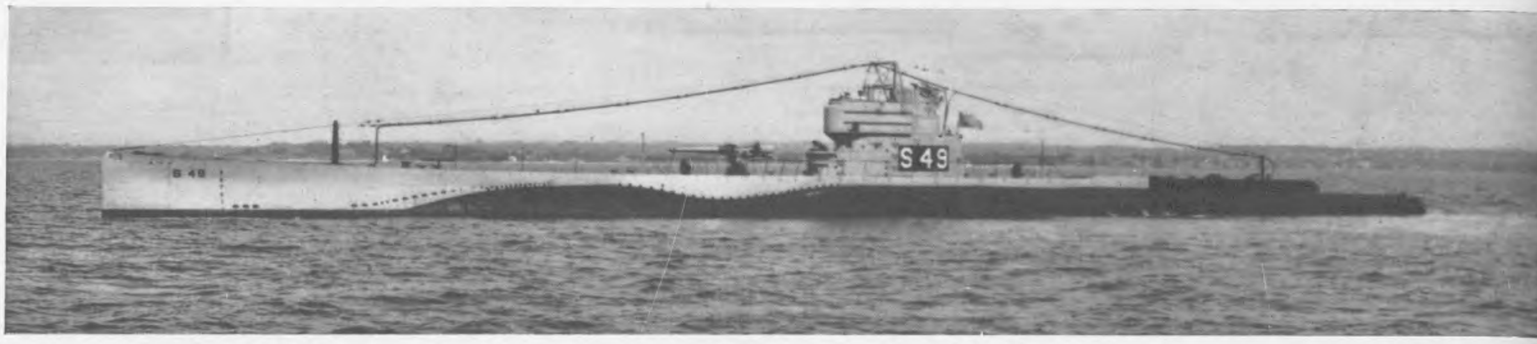


Fig. 1.—Busch Sulzer engined submarine S.49 on which Frauenfelder clutches are used

Friction Clutch for Oil-Engine Power Transmission

First Details of the Frauenfelder Flexible Clutch as Used on U. S. Submarines

FRICTION clutches are among the oldest known means for the transmission of power, and by reason of the innumerable applications to which they can be adapted, are susceptible of many variations. The friction between two surfaces brought in contact by means of the application of force, either directly through positive means or indirectly through springs, is the method employed, but the details can vary and take almost innumerable forms. Thus we have multiple disc friction clutches, either dry or lubricated, cone clutches, interior or exterior band clutches, single disc grip clutches, ball ratchet clutches, etc.

It will be recalled that many of the early Russian motorships up to 5,000 tons d.w.c. and 1,000 shaft h.p. utilized friction clutches and gears in order to reverse the propeller shafts; without these clutches the development of the motorship may have been retarded.

A new friction clutch which on account of its special features has been called "flexible clutch" has been recently introduced to the engineering world by Mr. J. Barraja-Frauenfelder, chief-engineer of the Lake Torpedo Boat Co., Bridgeport, Conn. This clutch, because of its unique features of design, is worthy of attention by our readers.

The basic principle involved in the E-F friction clutch is that of the application of friction between two grooved surfaces, one being the inside of a cylindrical drum, and the other, or moving surface, being composed of a series of shoes moving radially and outwardly from the center of rotation, as hereinafter described.

Perhaps the motive which brought about the design of this clutch is of interest as demonstrating the old adage: "Necessity is the mother of invention." While interested in the problem of transmission of power in submarines, and particularly in the method of connecting the main motors for submerged propulsion, the designer was confronted with the difficulty of so connecting these two main elements as to give the following essential features:

(1.) A connection such as to allow flexibility in case either the engine or the motor should be subject to misalignment due to the deformation of the structure of the ship either by heat conditions, deep submergence of the submarine, with consequent deformation due to pressure, or wear in the bearings of either of the main elements.

(2.) A connection such as to absorb or deaden vibrations in case that the flywheel of the engine acting in opposition to the rotating weight of the electric motor armature would introduce torsional vibrations in the intervening piece of shafting whereby its structure is subject to rapid crystallization and rapid breakage.

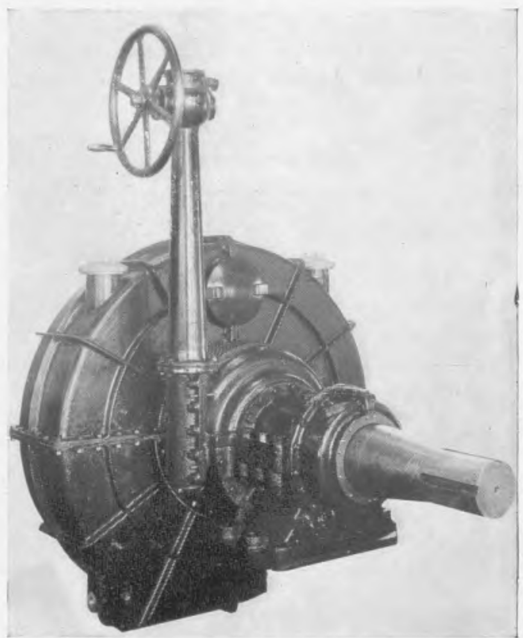


Fig. 2.—The Frauenfelder clutch

(3.) A connection capable of engagement and disengagement while under way.

The rapid strides in submarine construction and the contractual obligation assumed by the building company in meeting certain Navy delivery schedules precluded any possibility of lengthy studies of this problem before completion of the vessels, and for a long time a clutch (which is absolutely necessary between main engine and electric motor) had to be adopted pending the design and development of a more suitable one.

This temporary clutch, so to speak, had to be of the simplest form in order to be of ready manufacture, and for this reason the multiple jaw type was used, with the difference that instead of having four or six jaws as the ordinary commercial type, they were made with 40 or more jaws in order to make the engagement possible with only a slight amount of turning to get the jaws in alignment for connection.

But this makeshift only accentuated the fact that in submarine practice a solid connection between engine and motor was not a satisfactory means, and the clutch embodying the above enumerated three principles was absolutely essential. In time such a clutch was designed and an experimental one built.

In order to clearly understand the relation between the principal power elements in a submarine, Fig. 3 shows a typical submarine installation, and indicates the location of the clutch between engine and motor.

Fig. 2 illustrates a Frauenfelder clutch with the casing in position, and Fig. 5 shows the casing removed. Fig. 4 shows the assembly of the flexible clutch in which the desired features have been embodied.

It will be shown clearly in Fig. 4 that a series of shoes (B) move radially in piston-like guides and engage the grooved inside surface of the friction drum (A). Strictly speaking, the principles of flexibility involved in this design do not depend on the grooved surface for their function, but this kind of a surface has been selected because it offers the maximum amount of surface in the minimum of space, and this is important in large power installations. A plain cylindrical surface could be employed for small transmissions without disturbing the main elements of the design.

For convenience in selecting the most appropriate metals for the contact friction surfaces, and also for facilitating adjustment and manufacture, especially in clutches of large size, the shoes are made in two parts so that referring to Fig. 4 "A" is the friction drum which is made preferably of hard grade of cast iron, "B" the friction shoe which is made preferably of a soft grade of cast iron, and "E" is the shoe carrier made either of cast iron or bronze, the latter being the better material for naval work. The guides "DD" connect the shoe and the shoe carriers, and carry the load which the clutch has to transmit.

As mentioned above, the shoe carrier "E" is made cylindrical, and made to slide radially in appropriate cylindrical guides in the spider "D" and is held by cap "F". By removing the cap "F" the shoe carrier can be removed, and any adjustment on the spring that is necessary can be made.

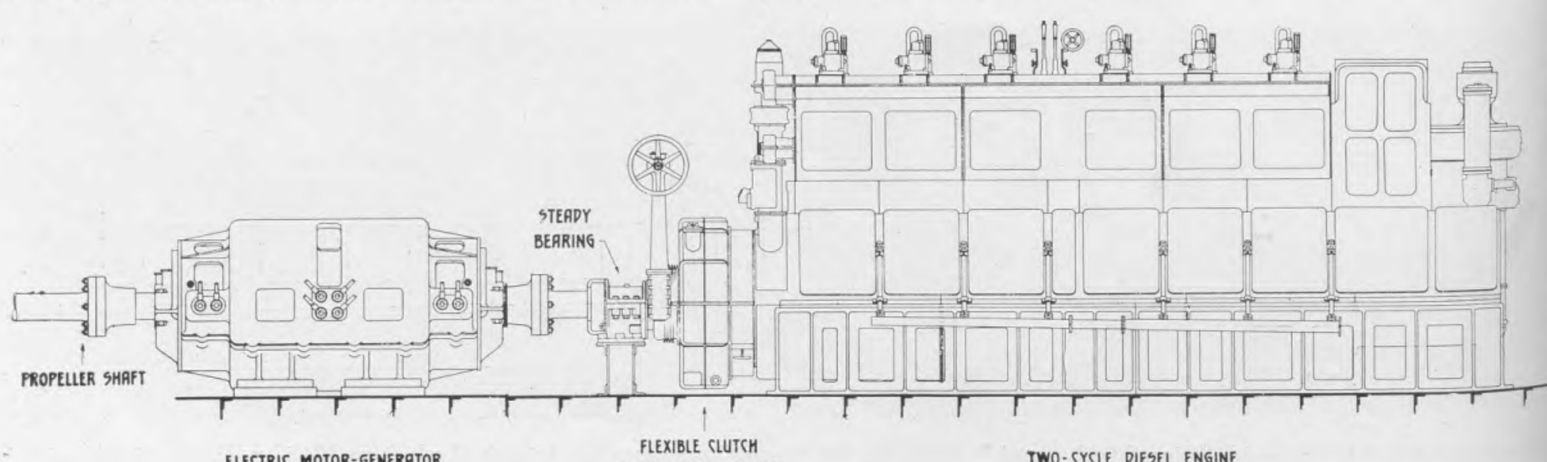


Fig. 3.—A typical submarine installation

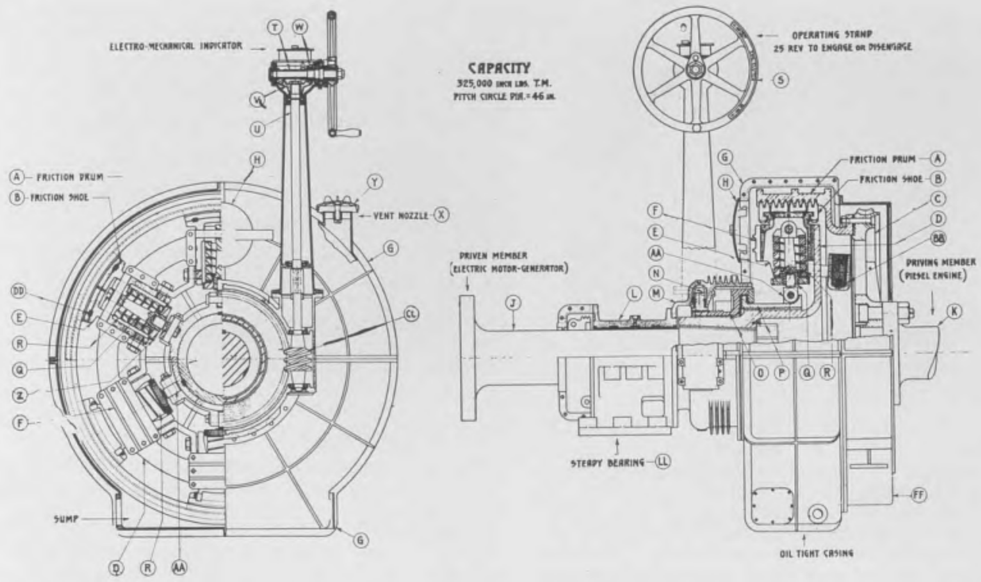


Fig. 4.—Details of design of clutch

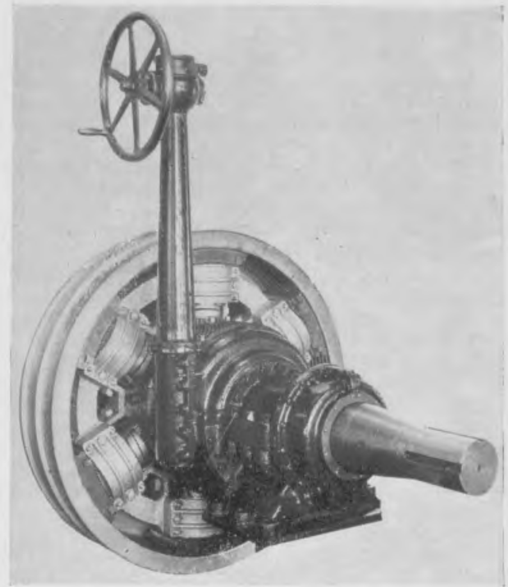


Fig. 5.—Clutch with casing removed

The sliding sleeve "P" is connected to each shoe carrier by means of an adjustable link "Q" with a pin in each end, and with a helical spring mounted on each link so as to be capable of adjustment according to the load it is proposed to carry.

The superiority of this spring adjustment has been proved by very exacting tests carried out by the Navy Department in order to prove the suitability of this clutch for submarine installations.

It will be noted that the hole for the pin in the outer end of links is elongated, which allows play between the link and shoe carrier. This relieves the tension on the spring when the clutch is released, and allows the link "Q" to pull back the shoe when the load must be withdrawn, while, when the load is engaged, the link first moves the shoe outward radially until the friction surfaces make contact, and continuing in its motion will compress the spring until the desired compression is reached in proportion to the load to be carried.

When the shoes wear down the connecting link "Q" can be adjusted by withdrawing the lower pin and unscrewing the lower link "AA" until the desired length is obtained to make up for the wear.

Another important feature is the construction of the friction shoe "B" which is carried by the shoe carrier "E" so as to permit of sufficient lateral movement to allow it to center itself into the grooves of the rim.

The main and most salient feature of this clutch is also the fact that the driving member "K" and the driven member "J" are not connected so as to hold the center rigid. In other words, if the steady bearing "L" by some unaccountable reason is allowed to drop slightly, the flexibility of the springs will allow the clutch to still run engaged and transmit the power without any damage to it or to the connecting parts.

The counterbalance weights "BB" are so arranged that they will offset the centrifugal force of the shoes and shoe carriers and facilitate the disengagement of the clutch when in motion.

The worm driving mechanism "N-CC" for moving the sleeve in and out is used for large powers only. Other recognized means for engaging and disengaging this clutch can be used without detriment to its important features.

The worm wheel "N" runs between babbitted surfaces in the casing "M", and also the shifting sleeve "O". In this region the greatest amount of heat is liable to be generated, and therefore casing "M" is provided with radiating fins as shown on photograph.

For large installations the clutch is enclosed in an oiltight aluminum casing "G" provided with a sump at its bottom for the collection of impurities, and with vent nozzles and adjustable caps "Y" so as to dissipate the hot air generated within the clutch casing.

Diesel engines which are used in all modern submarines are notoriously severe to the propeller shafting, and especially to the motor armatures and to the clutches on account of the very high pressure used, thus causing the fluctuation in turning moment to be of appreciable magnitude. Furthermore if there is a tendency in the engine flywheel to increase its angular speed above that of the motor armature by a sudden spurt, this will allow the shoes to slip if the springs are properly adjusted for this contingency.

If the engine crankshaft should drop in alignment by a few thousandths of an inch due to wear, or if the motor armature should likewise drop, this small discrepancy in alignment can with absolute safety be taken care of by the springs without causing undue stresses to either the motor or engine shafts.

Fig. 2 shows the exterior appearance of the clutch illustrated in Fig. 4, which was built in order to be tested by the Navy Department. Fig. 5 shows the interior, the oil casing being removed.

U. S. Submarine S-2 was equipped with this experimental clutch on one shaft, while the

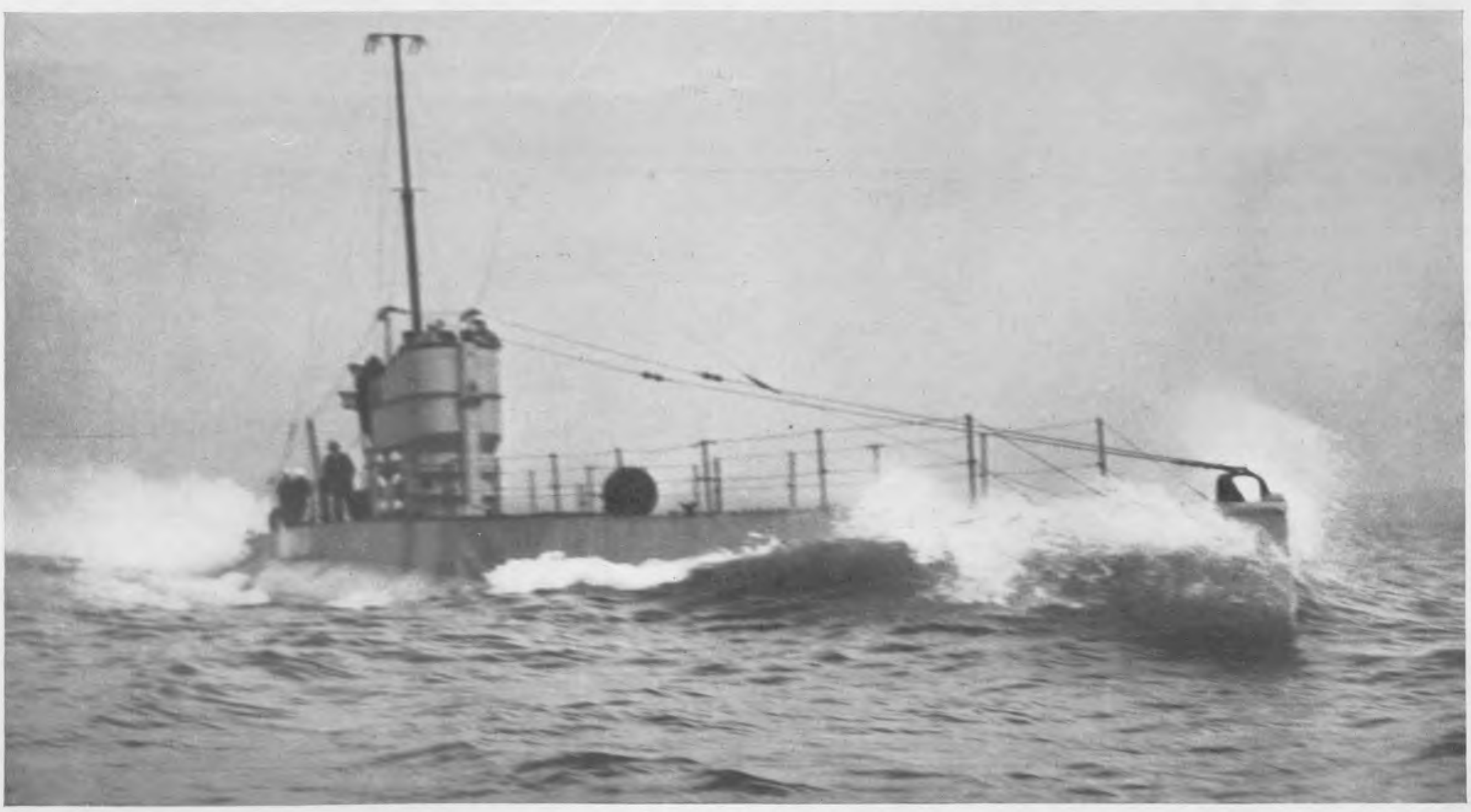


Fig. 6.—American submarine S-2 at full speed

other still retained the old style multiple jaw clutch. The vessel was sent to sea under the most severe weather conditions with orlers from the Department to keep at sea for forty-eight hours, and at stated intervals engage and disengage the clutch, and try to break it if possible. The clutch was designed to transmit a normal load at about 1,000 B. H. P. and capable of about 50% overload. It came through the ordeal with flying colors. No undue wear could be detected and no particular suffering in any way whatever from the rough use it received.

As a result of this experiment a new clutch was ordered by the Navy Department to be installed in place of the old multiple jaw clutch on the other shaft, and all the subsequent vessels built by the same concern were ordered to be equipped with this clutch, including those of the S-48 to 51 group.

Since the installation of the second clutch, the S-2 has completed (as reported in the daily press) an 8,600-mile voyage unescorted, making a trip from Portsmouth, N. H., to Pearl Harbor, Hawaii, in 29 sailing days. Fig. 6 shows Submarine S-2 at full speed.

In order to appreciate the importance of having a clutch on submarines which by all intents and purposes should act the same as an automobile clutch, that is, should be able to be engaged or disengaged while in motion, it must be noted that when coming to the surface from a submerged run a submarine if not equipped with such a device, but with a plain jaw clutch, is obliged to apply the brake to the propeller shaft in order to bring the jaws in alignment with each other before engagement, and this is a loss of valuable time which may be vital in the presence of an enemy. Vice versa, when diving and therefore disconnecting the engine, disengagement can commence before actually stopping the engine, and the motor gotten under way, thus saving also valuable time.

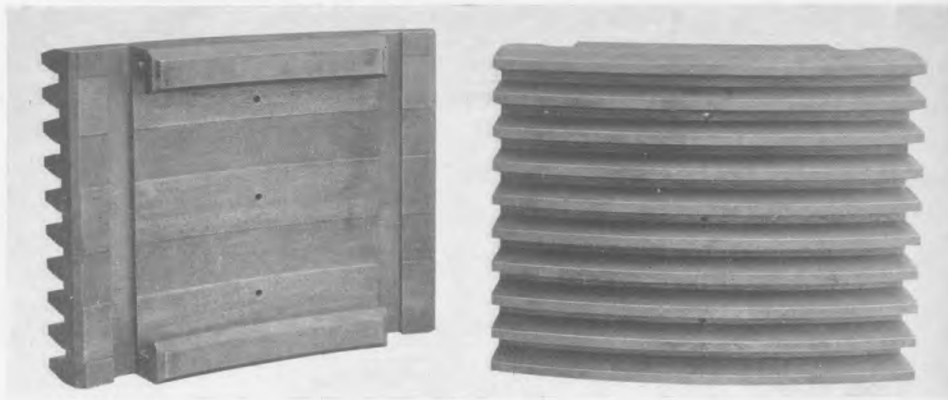


Fig. 7.—The clutch shoes

A practical demonstration was given on Submarine S-2 during the test, of the contention made above that abnormal vibrations can be absorbed by this type of clutch by the fact that the engine equipped with the jaw clutch could not be slowed down below 250 revolutions, while the one equipped with the flexible clutch could be throttled down as low as 200 revolutions, while on the other hand the engine equipped with jaw clutch showed critical vibrations at 275 revolutions, while the one equipped with flexible clutch showed no critical vibrations at all. This was due to the greater regularity of motion obtained with the engine equipped with flexible clutch.

The friction surfaces of this clutch are made ample enough so that a very low coefficient of friction can be used, permitting the functioning either dry or only slightly lubricated. For overload slipping regulation liberal lubrication is required, but it is not necessary to run this clutch in an oil bath.

Fig. 7 shows the construction of the interchangeable friction shoes with the oil passages clearly indicated. This clutch possesses sufficient virtues without the flexible feature to be adaptable to almost any other requirement, both on ships and land.

Swan Hunter & Wigham Richardson, Ltd., Newcastle-on-Tyne, England, who control the North British Diesel Engine Works, will build a couple of motorships in which North British four-cycle Diesels will be installed. Swan-Hunter also build the Neptune-Polar two-cycle Diesel engine described elsewhere in this issue, and being fitted in the Spanish tanker ARNUS.

An article on mechanical injection in Diesel engines was read in England on January 24 by Miss V. Holmes, before the Woman's Engineering Society.

TRAMORE and SYCAMORE are the names of the two Beardmore-Tosi Diesel-engined 6,000 tons motorships building by Richardsons Westgarth for Furness Withy & Co., of London and New York.

The Götaverken of Göteborg have received an order for a 2,000 i.h.p. 9,800 tons d.w. motorship from the Swedish East Asiatic Co. Altogether this shipyard has orders on hand for twelve motorships.

The American wooden motorship COOLCHA, operated by the Admiral Line, ran aground off Victoria, B. C., on February 15 during a severe storm that raged on two oceans and across the United States, when seven steamers were also reported in distress on the same day and three of them lost. The COOLCHA may be salvaged.

An order for three motorships has been placed with Wm. Doxford & Sons, Sunderland, England, by Furness Withy, owners of the Doxford-built motorship DOMINION MILLER. Furness Withy are also having two Beardmore-Tosi engined motorships built by Richardson Westgarth & Co.

A Doxford-Diesel engined motorship has been ordered by Stanley & John Thompson, of London, from Wm. Doxford & Sons, Sunderland.

Harland & Wolff expect to lay down the keels of two new Diesel-engined freighters of 9,500 tons gross each at their Belfast yard during February. One of these vessels is for the Royal Mail Steam Packet Company, and the other is for an owner whose name has not been disclosed. Both these vessels will be of about 14,000 tons d.w. and 6,200 i.h.p.

In a 600 tons passenger-vessel owned by the Osaka Yosen Kaisha, a Niigata Diesel-engine has been installed.

During 1922 Germany launched 12 motorships, aggregating 45,513 tons gross, according to Lloyd's report.

The wooden auxiliary motorship CAROLYN FRANCIS, powered with a McIntosh & Seymour Diesel engine, was recently used by a "movie" company on a five-weeks' whaling cruise, the whaling incidents and the crew of the ship being introduced with the actors into the scenario.

Electric motors and control gears for auxiliary purposes have been installed on the following 24 large British motorships by Laurence Scott & Co., Norwich, England, namely:

MISSISSIPPI	LA PAZ
GLENGYLE	DORSETSHIRE
GLENARTNEY	SOMERSETSHIRE
GLENAMOY	LOBOS
GLENADE	LOSADA
GLENARIFFE	LOCHKATRINE
GLENTARA	LEIGHTON
GLENLUCE	LINNELL
ABA	DINTELDYK
GLENOGLE	LOCHGOIL
GLENAPP	LOCHMONAR
GLENAVY	GLENGARRY

All these motorships have Harland & Wolff-Burmeister & Wain propelling Diesel engines installed.

It is the opinion of Sir Charles Parsons, inventor of the steam turbine, that the future of the motorship lies with the small Diesel cylinder in large numbers.

Diesel-engines are to be fitted in some of the 9,700 tons cargo-vessels building at the Kawasaki Dockyard for the Mitsui Busson Kaisha.

A cargo ship owned by the Kokusai Steamship Company is to have Diesel engines installed.

During 1922 Great Britain launched seventeen motorships, aggregating 78,341 gross tons (about 125,000 tons d.w.), according to Lloyd's Register report, nine of them being over 5,000 tons gross, and the largest 9,500 tons gross.

Twin 500 shaft h.p. Bolinder oil-engines have been sold to the Long Beach Dredging Company of Brooklyn, for installation in barges. They are rebuilt engines.

The O'Boyle Lighterage Company of New York City will equip two tug boats with 320 shaft h. p. rebuilt Bolinder oil-engines.

In an auxiliary schooner owned by Mr. Bodden, Grand Cayman, British West Indies, a 50 b.h.p. Bolinder oil-engine will be installed.

A 25 h.p. Bolinder oil-engine has been installed in Laurence Clay's of Stonington, Conn. fishing schooner.

MEDON is the name of the 8,000 tons d.w. single-screw motor-freighter launched on February 2nd, at Palmers Shipyard, Hebburn-on-Tyne, England, to the order of the Ocean S. S. Line of Liverpool (A. Holt & Co.). She has the following dimensions:

Length (O. A.) .... 423' 0"
Breadth .... 52' 3"
Depth to U. D. .... 32' 0"
Power .... 3,000 i.h.p.

In this vessel the new Danish-built slow-speed, single-screw Burmeister & Wain 3,000 i.h.p. Diesel engine has been installed by Palmers.

Unique Single-Screw Motorship's Maiden Voyage

Performance of the Royal Netherland Steamship Company's Werkspoor-engined Vessel "Rhea"—Successful Use of Exhaust Gases—Novel System of Deck Auxiliary Drive

If economy and reliable operation mean anything ultra-conservative to Dutch shipowners the performance of the new motorship RHEA on her maiden voyage will mean a rapid increase in the number of Diesel-driven vessels in the merchant-marine of Holland as the first voyage of this vessel has shown quite remarkable economy which cannot fail to impress those concerned. The Superintendent-Engineer of the Royal Netherland Steamship Co. of Amsterdam (Koninklijke Nederlandsche Stoombootmaatschappij) recently allowed MOTORSHIP to inspect the engine-room log of the RHEA covering her maiden voyage from Amsterdam to St. Thomas (West Indies) and return, which trip took 71 days, including calls at 20 different ports.

The total fuel-consumption both at sea and in port on this round voyage was just under 261 tons, of which only 184 tons was burned by the main engine, its consumption working-out at 0.305 lb. per i.h.p. hour of Diesel-oil fuel of 0.896 specific gravity. The consumption in port was high owing to the fact that the winches and lighting plant are operated by steam supplied by two oil-fired donkey-boilers instead of the more economical Diesel-electric system. But at sea sufficient heat is secured from the exhaust-gases of the single main Diesel engine for operating the steering-engine, heating and lighting the ship. The distance covered on the trip was 13,225 nautical miles. It will be interesting to receive the fuel-consumption of a steamer of similar net-cargo capacity over the same distance.

The RHEA is of 2,250 tons d.w. and is propelled by a Werkspoor four-cycle type 6-cylinder Diesel engine of 825 shaft h.p. at 135 r.p.m. On a round transatlantic trip she can carry close upon 2,000 tons of net cargo in addition to fuel, water and stores. She was built by Bodewes Bros. of Lobith, Holland. Her dimensions are:—

SINGLE-SCREW MOTORSHIP RHEA.

Net-Cargo-Capacity (Not including fuel, stores and water)	1,900 tons
Horse-Power	1,150 i.h.p. (825 shaft h.p.)
Engine & propeller speed	135 r.p.m.
Fuel consumption of main engine and auxiliaries at sea on 13,225 miles voyage (actual)	184 tons
Consumption per i.h.p. (all purposes at sea)	0.305 lbs.
Weight of main engine with flywheel	95 tons
Cylinder bore and stroke	20.472" x 35.433"
Length of engine without flywheel and thrusts	26'3"
Length of engine with flywheel and horse-shoe thrusts	36'1"
Diameter of crankshaft	12⅝"
Mechanical efficiency	72%
Mean-indicated pressure	89 lbs.
Length and breadth of ship	260' x 40'
Exhaust-gas temperature	645 degrees Fahr.

During the entire voyage the engine ran without any trouble whatever, and by means of the single fuel-pump, with distributor to each cylinder, it was found that the exhaust from all cylinders could be maintained at exactly the same temperature without any difficulty whatever, the log book showing almost invariably 590 degrees Fahr. at the exhaust outlet of every cylinder. Reversing the main engine occupied between 6 and 8 seconds.

One of the special studies made during the voyage was that of the application of the utilization of exhaust-gases for auxiliary power. Directly aft of the exhaust manifold the main outlet has two branches—one leading to the atmosphere and the other to a Scotch boiler of about 450 sq. ft. surface area. Flow of exhaust-gases in either direction is controlled by a flap valve. The boiler is provided with a superheater. On this voyage it was found possible to obtain sufficient steam by means of the exhaust-gases to maintain a pressure of 70 pounds, driving the steering-gear and lighting set under normal conditions. From temperature measurements taken it was ascertained that when the exhaust-gases enter the boiler they are cooled down to 466 degrees Fahr., the temperature after passing thru the boiler being 286 degrees Fahr.

When leaving the Diesel-engine cylinders the temperature of the exhaust-gases is 645 degrees Fahr., so that just as much heat is lost in the water-cooled exhaust-gas manifold as is absorbed by the boiler. Incidentally the thermometers will always show a figure several degrees below the temperature of the gases leaving the cylinders as the exhaust-gases are cooled in the elbow each time the exhaust valves close.

It has been demonstrated that the utilization of exhaust-gases is practical, even with a single-screw ship, and that a gain in power of about 1.2 per cent, is derived. However, were it possible to construct the exhaust manifold in the form of a steam boiler, the quantity of steam available would be nearly double. In the case of a more powerful and elaborate auxiliary steam plant with condensation and careful design of components, the steam consumption per b.h.p. could be reduced to one-fourth of the rate of that of the present non-condensing steering-engine. In such a case the total gain would amount to 9.6 per cent instead of 1.2 per cent.

It is found in the RHEA that the boiler acts excellently as a silencer, but it is important that the heating surfaces be kept perfectly clean. It seems possible that where desired additional steam could be secured by burning fuel-oil under the boiler in combination with the heat from the exhaust-gases. This has not been arranged for in the RHEA's installation.

Altho' steam is used for the winches, the usual run of steam winch has not been adopted for handling cargo, but the power of the winches is transmitted by shafting along the deck, this shaft being driven by a uniflow steam-engine in the engine-room. Winches may be coupled independently by means of friction clutches. So, it will be realized that the equipment of this vessel is somewhat unique. Illustrations of this winch arrangement were given in MOTORSHIP for July, 1922, page 526. Thus it will be seen that her steam auxiliaries are economical at sea, but inefficient in port when the main Diesel engine is shut down.

DR. RUDOLF DIESEL'S SON

Mr. E. Diesel, son of the famous inventor of the Diesel principle for oil-engines, is now residing in Stockholm, Sweden.

MAIDEN VOYAGE OF DIESEL-YACHT "BLACK SWAN"

This attractive new yacht built for R. C. Durant, manufacturer of Durant automobiles, has recently exhibited the efficiency and reliability of Diesel-engines through her non-stop run from San Francisco to Honolulu and return. She was completely described and illustrated in the September, 1922 issue, so we will simply repeat her chief dimensions which are: Length o. a., 130'; breadth, 22' and draft, 6'. As may be remembered, she is powered with two 200 h.p., six-cylinder Atlas-Imperial Diesel-engines installed amidships, and her fuel-tanks of 7,500 gals. afford a long cruising-radius. Such radius of action is appreciated on the Pacific Coast, as one of the favorite runs is to Honolulu, 2,200 miles off the California shore, and it was to this beautiful island that the first cruise of the BLACK SWAN was made.

In order to give the engines a good test non-stop runs were made both ways, and their performance was reported as perfectly satisfactory by Mr. Durant, and by Capt. C. M. Fry, master of the yacht. Although part of the voyage was made through very rough seas and a 40-mile gale, the engines functioned well driving the boat at ten and a half knots during this heavy weather. In smoother waters the speed is said to be 15 knots.

THE ISHERWOOD SYSTEM OF SHIP CONSTRUCTION

The progress returns for the Isherwood System up to the end of 1920 showed some remarkable figures regarding the number of orders placed, but a great falling off in shipbuilding generally has taken place since that time naturally is reflected in the number of contracts made for vessels to be built on the Isherwood System during the past two years. The following table, however, cannot fail to be of considerable interest as, in addition to recording the number and deadweight tonnage of Isherwood ships contracted for in each year from 1907 to 1922, it shows to some extent the general activities of the shipbuilding industry during that period.

Year	*Number of ships built, under construction and on order*	*Deadweight carrying capacity*
Sept. 1907 to Dec. 1908	6	31,608 tons
1909	36	212,992 "
1910	76	484,752 "
1911	140	958,795 "
1912	240	1,777,348 "
1913	270	1,993,034 "
1914	311	2,351,322 "
1915	468	3,548,221 "
1916	620	4,666,000 "
1917	800	6,332,150 "
1918	1,050	8,707,700 "
1919	1,260	10,594,700 "
1920	1,395	11,962,400 "
1921	1,418	12,032,400 "
1922	1,431	12,101,890 "

This table is analyzed as follows:

General cargo vessels, colliers, ore steamers, passenger vessels and Great Lakes freighters: 638, aggregating 5,755,070 tons deadweight carrying capacity.

Oil tank steamers: 660, aggregating 6,266,850 tons deadweight carrying capacity.

Barges, dredgers, trawlers and ferry boats: 133 aggregating 79,970 tons deadweight carrying capacity.

It is worthy of record that many of the above vessels are Diesel driven motorships, including the largest tanker in the world.

Earning Capacity of Cargo Ships

Motorships Have Rendered Term "Deadweight" Obsolete — "Net Cargo Capacity" the Proper Expression

By DR. ENG. CARL COMMENTZ

Editorial Note

All concerned with ships and shipping are vitally interested in the subject of earning capacity, which is so greatly influenced by the type of machinery installed in a ship. Dr. Commentz has given considerable study to this subject and incorporated the results of his researches in the accompanying article. All may not agree with his findings and it is possible that much discussion of points raised will result. We offer space to any who desire to contribute their opinions on this most important subject, the correct understanding of which is quite important to those who must decide between building motorships as against steamers.

DEADWEIGHT has always been used as an expression of the profitable capacity of a vessel, that portion of the total weight over and above the weights of hull and machinery. However, this term "deadweight" is misleading, including as it does the weight of fuel, fresh and feed water, stores, provisions, crew, equipment and cargo; all these amounts vary according to several factors so that for the same deadweight the cargo tons will vary greatly. Likewise these items of fuel, water, stores, etc., are necessary to the operation of the engines and the vessel and do not earn profits; they should not, therefore, be included in a figure usually intended to express the earning capacity of a vessel. "Cargo" is the factor which earns profits and MOTORSHIP has often stressed this point, i.e., that "net cargo capacity" should be generally used to express a vessel's earning power.

However, as all who are acquainted with shipping realize, cargo capacity is limited by fuel, stores, water and other weights which depend upon the type and power of machinery installed, the length of the voyage, speed of vessel, etc. It therefore seems pertinent to investigate this subject in a more thorough manner than has previously been done with a view to determining why the present method of buying, selling and chartering vessels is incorrect, not simply because it fails to credit the motorship with as large cargo-carrying capacity as it should, but because this expression fails to give ship owners a true idea of the actual earning capacity of a vessel. We have therefore compared steamships and motorships on a basis of average conditions and equal effective power.

Not only is the saving in weight of propelling engines and fuel bunkers advantageous to the motorship, but considerable saving in weight is effected by the absence of boiler feed water and by fuel and water consumed in loading and discharging cargo. In order to obtain average values for all factors concerned it is necessary to consider a number of cargo steamers of the same speed and horse power and arrive at average data; we have therefore tabulated this data on about 100 steamers as shown by the following table.

Displacement	Speed Knots	I. H. P.	I. H. P. per ton displacement	Mechanical Efficiency of Engine	Effective H. P.
1,800 tons	8.75	420	0.234	0.76	320
3,000 "	9.10	700	0.2335	0.78	546
5,000 "	9.50	1,165	0.233	0.80	932
8,000 "	10.20	1,850	0.232	0.83	1,535
13,000 "	11.00	3,000	0.231	0.87	2,610
20,000 "	12.00	4,600	0.230	0.91	4,195

For motorships the effective horsepower given in this table are valid, but only under the assumption that the revolutions of their engines and propellers is the same as in ordinary use with steam engines. When motorships were first built the revolutions of their engines was generally much higher than with steam engines; now, after about twelve years of development, they have been greatly reduced, in many cases to approximately that of steam engines. The reason for this development is, as is generally known, the higher efficiency of propellers of low revolutions. Under these circumstances, the assumption of equal revolutions is justified, but of course, the weight of these Diesel engines must be reckoned accordingly. It is true, the weight of Diesel engines depends on the system used, especially whether they are of the two- or four-cycle type. The latter type of engines of low revolutions are of about the same weight as steam plants, some two-cycle engines are lighter, weighing generally about 70 to 80 per cent. as much as those of the four-cycle type. It is not the object of this investigation to compare the merits of the different types with each other. Also, we do not want to be reproached with giving too favorable values for the motorships, but want to give a fair comparison. Therefore, as an average value the weight of Diesel engines is considered as being 90 per cent. of that of steam engines, boilers,feed water, etc. Then the weights of ships and engines and the deadweight capacities of the above ships are as follows:

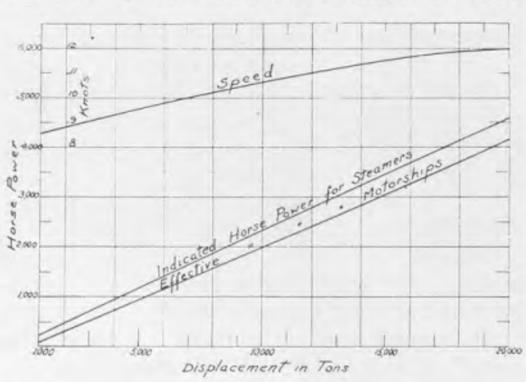


Fig. I

As may be seen by this table, and Figure II, the deadweight capacity of the motorship with slow-running engines is but slightly superior to that of the steamer, the difference being about 1 to 1½ per cent.

The factor which influences the weight of consumed fuel and water to the greatest degree is the length of voyage. It is a well-known fact that it is not economical to run small craft on long distances because their efficient earning (cargo) capacity is reduced too much by the weight of stores; on the other hand, it is universally recognized in practice, that large vessels are not generally suitable for short voyages, because the time necessary for discharging and loading is too long and the capital invested in the ship lies idle a long fraction of the year in the harbor. Therefore it is customary to run a certain distance with a ship of a certain size.

These distances differ considerably in some cases and at various times; in a time of depressed freight-rates it may be economical to send a ship on a longer voyage or to bunker her for the port of destination and return. Therefore, it was somewhat difficult to decide upon the average relation between a ship's size and its normal length of voyage. This has been done by collecting considerable data on the subject from trades in all parts of the world. Likewise the time necessary in port for the ships has been obtained in the same way. The result of this investigation is given in the following table:

Displacement	Length of Voyage	Reserve for Stores	Time in Ports
1,800 tons	1,000 miles	20%	4 days
3,000 "	1,700 "	15%	6 "
5,000 "	2,850 "	12%	8 "
8,000 "	4,500 "	10%	11 "
13,000 "	6,750 "	10%	15 "
20,000 "	9,000 "	10%	20 "

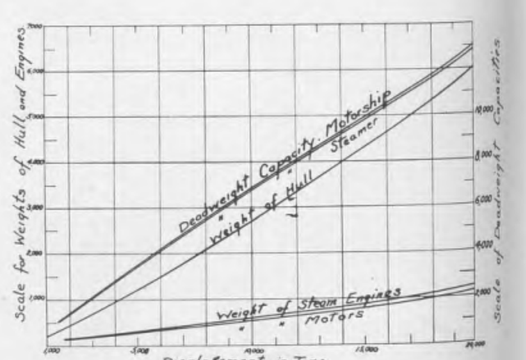


Fig. II

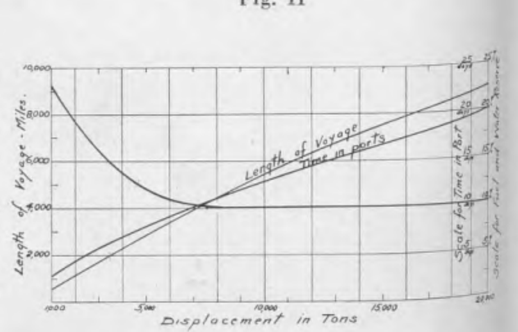


Fig. III

Displacement	Ship's weight in % of displacement	Ship's weight total	Engine's weight per indicated Steam H. P.	Engine's Total S. S. tons	Engine's Total M. S. tons	Deadweight Capacity Steamship	Deadweight Capacity Motorship
1,800 tons	21.2	396 tons	0.287 tons	122 tons	110 tons	1,283 tons	1,294 tons
3,000 "	23.0	690 "	0.280 "	196 "	176 "	2,114 "	2,134 "
5,000 "	24.0	1,220 "	0.270 "	315 "	283 "	3,465 "	3,497 "
8,000 "	26.2	2,080 "	0.260 "	483 "	435 "	5,437 '	5,485 "
13,000 "	28.0	3,640 "	0.253 "	760 "	684 "	8,600	8,676 "
20,000	30.0	6,000 "	0.250 "	1,150 "	1,035 "	12,850	12,965 "

In this table there is also included a reserve for detention of the ship by unfavorable weather, as generally provided for bunkers and water, this reserve of course being smaller with long voyages, as the probability of meeting relatively long storms decreases.

The amount of fuel necessary to produce one horsepower decreases with the size of engine. The values of this item given for steam engines apply to standard engines of the reciprocating type. They are practical average values lying between those for engines with and without superheating, but do not include feed water. As concerns motorships, medium values between two- and four-cycle engines are given The consumption of feed water on steamships depends largely on the engine and the care given by the engineer; in practice it averages 0.08 to 0.20 kg. (0.176 lb. to 0.44 lb.) per indicated horse-power per hour; as a fair average 20 per cent. of the coal both that consumed and reserve may be considered proper. Therefore, the supply needed for a voyage may be determined on the following basis:

Displacement	Coal per I. H. P. hour	Feed Water per I. H. P. hour	Oil per E. H. P. hour
1,800 tons	0.80 kg.—1.76 lbs.	0.16 kg.—0.35 lb.	0.235 kg.—0.51 lb.
3,000 "	0.75 kg.—1.65 lbs.	0.15 kg.—0.33 lb.	0.220 kg.—0.48 lb.
5,000 "	0.69 kg.—1.51 lbs.	0.14 kg.—0.30 lb.	0.210 kg.—0.46 lb.
8,000 "	0.65 kg.—1.43 lbs.	0.13 kg.—0.28 lb.	0.202 kg.—0.44 lb.
13,000 "	0.60 kg.—1.32 lbs.	0.12 kg.—0.26 lb.	0.195 kg.—0.42 lb.
20,000 "	0.60 kg.—1.32 lbs.	0.12 kg.—0.26 lb.	0.190 kg.—0.41 lb.

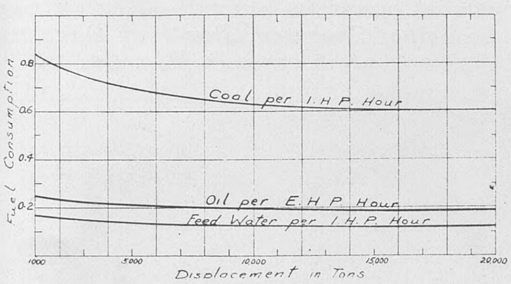


Fig. IV

While in port there are in the case of a steamer two kinds of fuel consumption to be considered; first, fuel and water necessary to keep the boilers warm, second, fuel and water for driving the winches while discharging and loading cargo. Where this is handled by cranes standing on the docks the fuel consumed by the ship's winches is but small. On the other hand the cargo is often loaded and discharged during a voyage by the ship's winches alone.

On an average based on practical experience about 7 kg. (15.4 lbs.) of coal and about 3 kg. (6.6 lbs.) of water are necessary per ton to discharge and load cargo. To keep the boilers of a steamer warm a fuel consumption of about 10 per cent. of that while driving the ship is necessary, whereas a motorship has no standby fuel-consumption. Likewise the consumption of fuel for loading and discharging is only a small fraction of that of a steamer, as the electric winches are much more economical than the steam winches of steamers. In fact, a consumption of 0.5 kg. (1.10 lbs.) of oil per ton cargo is ample, this being one twentieth of the weight of coal and water which must be reckoned for steam winches.

While these figures may seem improbable they are based upon practical experience. With the steam winches much steam pressure is lost through condensation in the long pipe lines on deck and by exhausting, while electricity is generated by sets driven

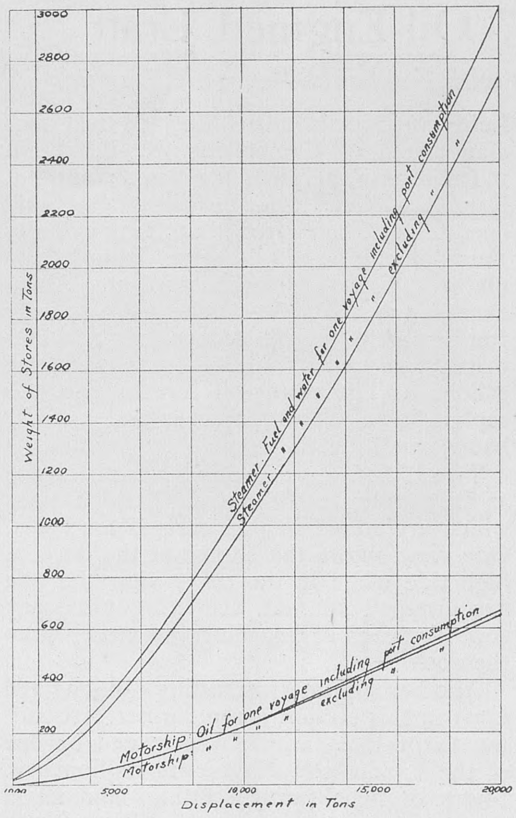


Fig. V

by economical Diesel engines and only small losses are experienced. All items considered, the weight of coal and water necessary for one voyage are as follows:

Displacement Tons	Fuel & Water for running and reserve Tons S. S.	M.S.	Fuel for lying in Ports Tons S. S.	M.S.	Fuel & Water for loading & discharging Tons S. S.	M.S.	Total Stores Necessary for one voyage S.S.	M.S.
1,800	55.3	10.3	3.2	...	11.2	0.6	69.7	10.9
3,000	135.4	25.8	7.6	...	19.7	1.0	162.7	26.8
5,000	324	65.8	15.4	...	31.3	1.7	370.7	67.5
8,000	702	150.0	31.8	...	42.0	2.6	775.8	152.6
13,000	1,460	343.5	64.8	...	70.8	4.1	1,605.6	347.6
20,000	2,732	656.0	132.5	...	100.0	6.1	2,964.5	662.1

The relation existing between the weight of stores for steamers and for motorships is fully illustrated by the following table in which the stores are given as percentages of the deadweight capacities of the ships.

Displacement	Steamer	Motorship
1,800	69.7 : 1,282 = 5.4%	10.9 : 1,294 = 0.85%
3,000	162.7 : 2,114 = 7.7%	26.8 : 2,134 = 1.21%
5,000	370.7 : 3,465 = 10.7%	67.5 : 3,497 = 1.94%
8,000	775.8 : 5,437 = 14.2%	152.6 : 5,485 = 2.97%
13,000	1,605.6 : 8,600 = 18.7%	347.6 : 8,676 = 4.02%
20,000	2,964.5 : 12,850 = 23.1%	662.1 : 12,965 = 5.13%

The weight of the stores of a motorship as a percentage of that of a steamer runs as follows:

1,800	10.9 : 69.7	15.7%
3,000	26.8 : 162.7	16.5%
5,000	67.5 : 370.7	18.2%
8,000	152.6 : 775.8	19.7%
13,000	347.6 : 1,605.6	21.5%
20,000	662.1 : 2,964.5	22.3%

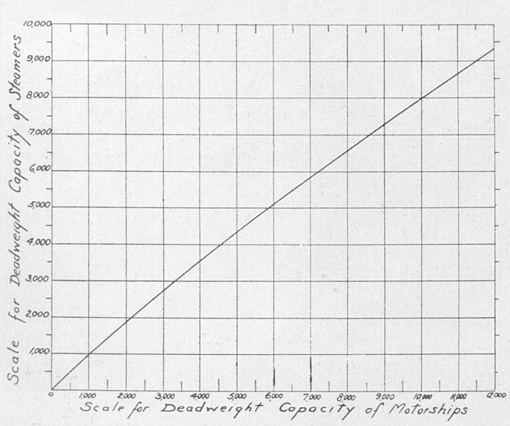


Fig. VI

Finally the effective cargo capacities of the ships and the percentages of the deadweight capacity works out as follows:

Displacement	Effective Cargo Capacities — Steamer tons	% of deadweight	Motorship tons	% of deadweight
1,800	1,213.3	94.6	1,283.1	99.15
3,000	1,951.3	92.3	2,107.2	98.79
5,000	3,094.3	89.3	3,429.4	98.06
8,000	4,661.2	85.8	5,332.4	97.03
13,000	6,994.2	81.3	8,330.4	95.98
20,000	9,885.5	78.9	12,303.0	94.87

By these figures it is possible to compare the earning ability of the two types expressed in deadweight capacities, which was the final aim of this investigation, as follows:

A MOTORSHIP of the following deadweight capacity	has the same cargo-capacity as a Steamer of	A MOTORSHIP of the following deadweight capacity	has the same cargo-capacity as a Steamer of
960 tons	1,000 tons	5,550 tons	6,600 tons
1,140 "	1,200 "	5,700 "	6,800 "
1,320 "	1,400 "	5,850 "	7,000 "
1,500 "	1,600 "	5,990 "	7,200 "
1,680 "	1,800 "	6,140 "	7,400 "
1,850 "	2,000 "	6,290 "	7,600 "
2,030 "	2,200 "	6,430 "	7,800 "
2,200 "	2,400 "	6,580 "	8,000 "
2,370 "	2,600 "	6,720 "	8,200 "
2,540 "	2,800 "	6,870 "	8,400 "
2,710 "	3,000 "	7,010 "	8,600 "
2,880 "	3,200 "	7,150 "	8,800 "
3,040 "	3,400 "	7,290 "	9,000 "
3,210 "	3,600 "	7,430 "	9,200 "
3,370 "	3,800 "	7,570 "	9,400 "
3,530 "	4,000 "	7,710 "	9,600 "
3,690 "	4,200 "	7,850 "	9,800 "
3,850 "	4,400 "	7,990 "	10,000 "
4,010 "	4,600 "	8,730 "	10,200 "
4,170 "	4,800 "	8,260 "	10,400 "
4,330 "	5,000 "	8,400 "	10,600 "
4,480 "	5,200 "	8,530 "	10,800 "
4,630 "	5,400 "	8,670 "	11,000 "
4,790 "	5,600 "	8,810 "	11,200 "
4,940 "	5,800 "	8,940 "	11,400 "
5,090 "	6,000 "	9,070 "	11,600 "
5,249 "	6,200 "	9,200 "	11,800 "
5,400 "	6,400 "	9,340 "	12,000 "

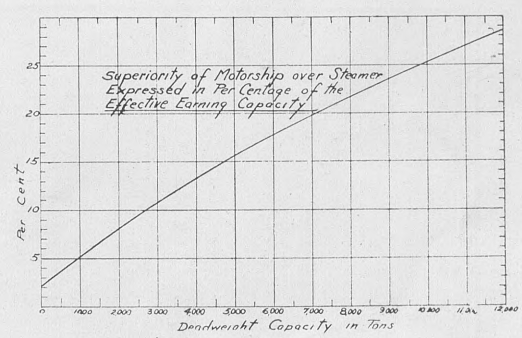


Fig. VII

The above values are well illustrated by Figure 6 and the importance of the superiority of the motorship is readily noted from Figure 7, which shows the percentage by which a motorship exceeds the effective earning capacity of a steamer of the same deadweight capacity. Thus is well illustrated the advantages of installing machinery of the most efficient type in cargo ships. It will also be readily seen that in the case of a motorship a certain net cargo capacity can be obtained by building a smaller hull than in the case of a steamer, with resultant lower costs. However, this advantage of a motorship is not always recognized, although further savings are possible in this smaller vessel through smaller crew, tonnage dues, etc. These points have not been stressed by us, however, our chief object being to demonstrate the larger net cargo capacities of motorships as compared to steamers.

MANY MOTORSHIP ORDERS

Contracts for six motorships and four Diesel-engined barges are now held by the Sun Shipbuilding Co. of Chester. Construction on the four Diesel-electric hopper dredges for the U. S. War Department is about to be commenced at this yard.

Typical "Down East" Oil-Engined Craft

Motor Work-Boats of the Maine Coast with Fairbanks-Morse Oil Engines

To those of our readers who have never visited the shores of our most Eastern state, Maine, it is impossible to convey in words a picture of that most interesting section of the coast. Great evergreen-covered rocky headlands extend far out into the sea in some spots, with deep bays and coves reaching far up between these rocky promontories. In Summer much of this coast is the mecca of yachtsmen and sportsmen, whose craft mingle with those of the fishermen who must earn their living afloat throughout the year. Their craft are plain, rugged little vessels powered for the most part with oil-engines. Not only are the fishing-boats numerous, but all the transportation of the coast-section is done by boat.

Among this fleet handling passengers and freight is one quite interesting craft, the LUBEC, owned by the Passamaquoddy Ferry & Navigation Co. of Lubec, Me., this craft being an important link in the passenger, freight and mail transportation facilities. She is a converted steamer, having been built in Portland, Me., in 1891, of oak frame and hard pine planking. She is of 49 tons gross, 27 tons net and is of the following dimensions: length, 69′ 6″; breadth, 18′; depth of hold, 6′ 3″, and draws 9′ when running. She is licensed to carry 192 passengers and operates between Eastport, Lubec and North Lubec, Me., and the Canadian island of Campobello, N. B. Until 1917 she was operated by a steam plant, but Ralph Hindley, who purchased her and operates her, had a 100 b.h.p. four-cylinder Fairbanks Morse oil-engine installed in place of this obsolete steam-plant. At an average speed of 9 knots she makes a daily run of about 54 miles, consuming approximately 40 gallons of kerosene and five gallons of lubricating-oil for the trip. A captain, a pilot, one engineer and a deck-hand constitute the crew.

Two illustrations of this boat are shown, as they indicate the extremely high tides which are found in this part of the coast. One view shows the LUBEC at the dock at high tide while in the other view the tide has dropped 28 feet, rendering necessary several means of boarding the vessel from the dock.

Another quite interesting oil-engined craft in this section is the former fast sailing yacht BESS, which was owned by one of the Vanderbilts, New York millionaires. Shorn of her beautiful fittings and finish this craft, now known as the WHILEAWAY, is now doing duty as a fish carrier for the Booth Fisheries Co., by whom she was purchased in 1917. She is of 15 tons, 72 feet length, 19′ 8″ breadth, 6′ 0″ depth and carries 90 hogsheads of herring. She has also been sent down the coast for pollock, hake, cod, etc., often carrying as much as 100,000 lbs. Her power plant is a Fairbanks Morse oil-engine which drives her at 10 knots.

Another illustration shows the CAMPOBELLO, also powered with a Fairbanks Morse oil-engine of 45 h.p., which drives her 8 knots, carrying 95 hogsheads of herring. She was formerly a steamer performing similar work as the LUBEC, but after being purchased by Ramsdell & Mahennie, sardine packers of Lubec, the steam plant was replaced by the more economical oil-engine. She is 63′ 4″ long, 16′ 5″ breadth and 6′ 0″ depth.

One of a fleet of five sister-vessels owned by the Booth Fisheries Co. is illustrated in the BLACK DIAMOND, 64′ 6″ long, 15′ [illegible] breadth and 5′ 8″ depth. All are powered with 60 h.p. Fairbanks Morse oil-engines and attain a speed of 10 knots, their cargo capacity being 60 hogsheads. Carrying these their fuel-consumption is five gallons per hour. The crew numbers four men.

Award for the construction of the [illegible] Diesel - electric pipe-line dredge has been made by the U. S. War Department to the Charles Ward Engineering Works, of Charleston, W. Va.

"Prosperity in the United States depends largely on the re-establishment of the purchasing power in Europe."—*General [illegible] E. Tripp, Chairman, Board of Directors, Westinghouse Electric & Mfg. Co.*

Oil-engined boats of Maine. Upper left, the "Black Diamond"; lower left, the "Whileaway"; upper right, the "Campobello"; lower right, the "Lubec," at high and low tide

Enterprise Diesel-tug "Myrtle" of San Francisco

Three Enterprise Diesel-Tugs for One Firm

San Francisco Tow-Boat Owner Discards Distillate-Engines

One of the most progressive operators of freight and towing craft on San Francisco Bay is George Wallenrod, who is rapidly replacing his distillate-powered boats with Diesel power. His experience with the former type of power has been most thorough and he frankly states in a letter to MOTORSHIP that he was first somewhat dubious of the newer Diesel-power. Therefore, his verdict after several months of actual service is worthy of attention and should carry weight.

His first Diesel installation was a three-cylinder 100 b.h.p. Enterprise in the tug TILLIE W. to replace her distillate-engine. Two weeks after she was put into operation her economy was so marked that two crews were put on board in order that the tug could be operated day and night and thus reap full benefit from her reliable and profitable operation. The men operating these boats are experienced "gas-engine" men who have been able to turn to the Diesel-engine and operate it without difficulty, enabling them to give dependable service. Mr. Wallenrod mentions one advantage of the Diesel-powered craft as being completely lacking the sickening exhaust and engine-room gases of the gasoline and distillate-engines.

Not only are the gases in these tugs sickening, but he further states that after giving the matter of ordering a second Enterprise Diesel-engine complete study from every possible angle and hesitating somewhat because of short period of service, two months more of gasoline bills prompted him to replace a second boat, the MYRTLE, with an Enterprise 100 b.h.p. After watching the performance of this second boat for one month he placed a third order for a three-cylinder 125 b.h.p. Enterprise Diesel-engine for the VERA.

In the words of Mr. Wallenrod is expressed the sentiment of the progressive men who are keen enough to see the advantages of Diesel-power when he says "This triplicate order is the greatest boost that we could possibly give—not to Diesel power, not to the Enterprise Engine Co., but to ourselves." Thus it is that such men recognize that their adoption of the most economical and reliable power not only redounds to the credit of the manufacturer but places the owner himself in a position of greatest advantage.

There are those who may feel that we may not always tell the entire facts about an installation; therefore such readers will be interested in the following quotation from Mr. Wallenrod's letter: "Now as to the performance of these engines, we have had our TILLIE W. in continuous operation over a period of six months, the running time of boats averaging approximately 300 hours a month. The MYRTLE has been in operation three months. Valves in the TILLIE W.'s No. 1 cylinder were lifted at the end of 600 hours' running and were found nearly perfect, five minutes being required to put the seat in first-class shape again. No. 2 cylinder valves were lifted after 1,200 hours' running, and we were so surprised at the nearly perfect condition of these valves that we decided to leave No. 3 go along indefinitely, or at least until she showed signs of needing it. The MYRTLE has not even had her fuel-nozzles removed for cleaning, even though their condition is inspected from time to time."

These tugs are normally operated as one-man boats, pilot-house controls being provided which function perfectly. As the illustration of the MYRTLE indicates, the pilot-house is convenient to the towing bitts, while there is also direct access to the engine-room. Such craft should be more generally used on the East coast, as operators of tugs on the Pacific coast have adopted this design quite generally.

The 100 b.h.p. Enterprise Diesel-engines in these Wallenrod tugs use Diesel-oil of about 24 degrees Baumé, costing three cents per gallon locally, and they consume 4½ gallons per hour, thus costing but 13½ cents per hour. Ozol Diesel lubricating-oil costing 60 cents per gallon and distributed by the Petroleum Products Co. of California, adds a cost of five cents per hour, making the total cost for fuel and lubricating-oil 18½ cents as against a previous cost of $2.56 per hour for operating the distillate-engine. These engines turn a 50″ diameter propeller at 320 r.p.m.

ROTTERDAM-LLOYD ORDER LARGE MOTOR-LINER

Just as we were closing for press we received cable advices from one of our European correspondents that an order for a 14,000-ton gross passenger motor-liner has been placed by the Rotterdam Lloyd Line of Rotterdam, Holland, for trans-atlantic service. This vessel will be constructed by the De Schelde Co. of Flushing, and will be powered with twin 3,500 Sulzer six-cylinder two-cycle type Diesel oil-engines. The latter will be constructed under license from Sulzer-Freres of Winterthur, Switzerland, who are partners of the firm of Busch-Sulzer Bros. Diesel Engine Co. of St. Louis, Mo., U.S.A. The new motorship will have a speed of 15 knots and the engine will be direct connected, turning the propellers at 85 r.p.m. She will be a sister vessel to the twin-screw turbine driven liner PATRIA.

BURMEISTER & WAIN DOUBLE-ACTING ENGINE

According to one of our correspondents, satisfactory runs over three weeks' duration have been made by the new double-acting Diesel engine in the test-house of the Burmeister & Wain plant, Copenhagen. This is a single-cylinder engine of the four-cycle type, developing 1,200 to 1,500 i.h.p. per cylinder, according to the revolutions. Should the final trial be satisfactory, it is probable that a twin installation of a total of 14,000 i.h.p. will be installed in a passenger liner of a Norwegian shipping company, each engine developing 7,000 i.h.p. in six cylinders.

LAUNCH OF M. S. "ARABY"

The new single-screw motor freighter ARABY was launched at the Archibald McMillan shipyard, Dumbarton, Scotland, on February 1st. She has been built to the order of David MacIver & Co., Liverpool, England. Her dimensions are:

Deadweight Capacity	7,800 tons
Power	3,000 i.h.p.
Length (b.p.)	380′0″
Breadth	53′0″
Depth to U. D.	29′0″
Draft	26′0″
Engine	8 cyl. Harland & Wolff B. & W.

The Burmeister & Wain engined motorship "Louisiana," placed in service last year

Trials of Fruit-Carrier "Pizarro"

Second Beardmore-Tosi Diesel-Engined Single-Screw Motorship Now in Service

Sea trials of McAndrews' second Diesel-propelled 2,000 tons deadweight fruit-carrier, the PIZARRO, sister motorship to the PINZON, were recently carried out with success on the Clyde estuary. Both craft were built by Wm. Beardmore & Co., Dalmuir, Scotland, and are single-screw craft, each fitted with a six-cylinder, four-cycle, 1,200 shaft horsepower Beardmore-Tosi Diesel-engine turning at 120 revs. per minute. These tests are not of little importance as the company has lately received an order for the Diesel engines of a 11,000 tons freighter to be built at the Blythwood Shipyard, which like the PIZARRO and PINZON will have all Diesel-electric auxiliaries, no steam being used for any purpose.

On these trials the following records were obtained on the run from Cloch to Cumbrae Lights and back by the PIZARRO—mean sea speed, 12 knots; mean revolutions per minute, 123.25; mean brake horsepower, 1,390; temperature of sea inlet to engine, 45 deg. Fah.; temperature of cooling outlet from engine, 115 deg. Fah.; piston-cooling water outlets, 99 deg. Fah.; temperature of exhaust gases, 600 deg. Fah.

Trials of the sister motorship PINZON were given in MOTORSHIP last year, as well as a general description of the vessel. With the Beardmore-Tosi design of oil-engine the valves alternate from inlet to exhaust by means of a director valve, and thus work at only half the speed of the valve gear in the usual four-cycle Diesel engine. This arrangement gives a silently operating valve and reversing gear, and also goes far toward eliminating the routine changing and grinding in of exhaust valves.

No boilers are installed in the vessel, and all heating and cargo working is done electrically, the power being obtained from Diesel-driven auxiliary generators. The general comfort of the ship and the efficiency of the electric heater system was remarked upon. The fuel consumption at sea for all purposes works out under 5 tons per day, or about one-quarter that of a coal-fired steamer of the same size and equal speed. In addition to the runs over the measured mile at Skelmorlie, the usual manœuvring, reversal and astern running trials were also carried out to the requirements and satisfaction of the representatives of Lloyd's Registry.

The Beardmore-Tosi engined fruit carrier "Pizarro"

The New McDougal Motor Freighters

Diesel-Electric Propulsion for Canal Vessels

Some further details are now available regarding the two Diesel-electric propelled barges now being built for the McDougal Terminal Warehouse Co., for the New York State Canal traffic, and which will be operated by the Minnesota Allwater Transit Company of Duluth. These craft, it will be remembered, are to be of 2,000 tons deadweight, 254 ft. long, 42 ft. beam, and are from designs by Henry Penton of Cleveland. As they are the first big Diesel-electric barges ever built, their operation will be watched with considerable interest. Also, their Diesel engines will be the first sets constructed commercially by the Lombard Governor Company of Ashland, Mass. Henry Schreck is the chief-engineer for the engine builders, and will be remembered by our readers from his contributions to the editorial pages of MOTORSHIP in the past.

The barges are to be operated on the Great Lakes and the New York State Barge Canal during the summer months and between the West Indies and Atlantic ports during the winter season. The electrical equipment is being manufactured by the General Electric Company, and delivery will be made in April. It is expected the barges will begin operation a month later.

The equipment of each barge will consist of two 375 b.h.p. Lombard Diesel engines burning residual oil, and directly connected to drive two 250 horse-power electric motors, the surplus power being for the refrigerators. The motors are rated at 180 revolutions per minute which will give the barge a speed of approximately eight knots. There will also be a 40-kilowatt auxiliary generator driven by an 80 b.h.p. Lombard Diesel engine to be used when the barges are in port. All auxiliary equipment will be electrically operated.

The outstanding features of the electric drive over the steam-engine drive are flexibility and economy. But one-third of the amount of fuel-oil will be required with Diesel-electric system as compared to a steam-driven barge of the same tonnage. The barges will be controlled from the pilot-house much the same as an electric locomotive. By moving the handle of the controller, electricity is gradually applied to the motor increasing the speed, and a reverse can be made by throwing the same handle in the reverse direction.

ITALIAN OIL-ENGINE SUBSIDIES

Under the new decree issued by Signor Mussolini, marine-engine builders will be given a subsidy of 50 lira per indicated horse-power for oil-engines, and 20 lira per i.h.p. for steam reciprocating-engines, 11 lira per quintal for boilers and 23 lira per h.p. for turbines. Steel hulls receive a subsidy of 55 lira per ton. Materials for their construction will be admitted free of duty to the extent of 140 kilograms per horse-power. The total subsidy will amount to 150,000,000 lira and is spread over four years. Hence, it appears that an Italian motorship of 10,000 tons and 4,000 h.p. will receive a total subsidy of 750,000 lira, or about $37,500 at the low current exchange rates, or $150,000 at normal exchange rates.

DIESEL ENGINE CLASS AT UNIVERSITY OF CALIFORNIA

The University of California Extension Division has organized class instruction in San Francisco, in Ships and Shipping. Charles F. Gross, Assistant Professor of Marine Engineering and Naval Architecture at the University, is the instructor of the first course, which is an elementary one, and consists of ten 1½ hour lectures, including the Diesel and reciprocating steam engines together with the various types of drive.

LARGE DYNAMOMETERS FOR OIL-ENGINE TESTING

The Fairfield Shipbuilding & Engineering Co., Ltd., of Govan, and J. G. Kincaid & Co., Ltd., of Greenock, recently placed orders with Heenan & Froude, Ltd. for dynamometers capable of absorbing up to 6,000 b.h.p. at from 95 to 140 r.p.m., and up to 4,000 b.h.p. at from 125 to 180 r.p.m.

Herringer & Scott's Western Diesel-tug "Glencove"

Successful Western Diesel-Engined Tug

"Glencove" Saving Her Owners Three Thousand Dollars a Year

On the West coast a very marked transition is taking place from distillate to oil-engine power, in every case resulting not only in greater reliability, less cost of upkeep and greater satisfaction, but in enormous saving in fuel costs. In the face of such economy it is difficult to understand why some work-boat owners in other sections of the coast continue to operate boats powered with such expensive engines as gasoline engines and small steam-plants.

An instance of these worth-while savings is found in the tug GLENCOVE owned by Herringer & Scott of Rio Vista, California, equipped with a four-cylinder 100 b.h.p. Western Diesel-engine which replaced an 80 h.p. distillate-engine, usually called "gas-engine" on the Coast. This vessel is typical of the moderate size work-boat, being of the following dimensions: Length o.a., 57'-4"; Breadth, 15'-7"; Depth, 6'-4".

The propeller fitted is of 50" diameter and 48" pitch, which drives the boat at 11.2 statute miles an hour when turning at 300 r.p.m. Fuel of 16 and 17 degrees Baumé is used, and such is the company that after a short time of operation it was estimated that the cost of fuel for one year's operation would amount to about $600, whereas the yearly cost of fuel for the former distillate-engine was about $3,600.

Western Diesel-engines are of the Hvid type in which fuel is injected at practically atmospheric pressure into a chamber of the nozzle and ignited by compression therein, the fuel being forced through small openings into the combustion-chamber itself. No highly compressed-air is therefore required for injection, but a small air-compressor is fitted for providing starting-air. A simple governor of the centrifugal type is driven off the end of the camshaft by means of helical gears and directly controls the quantity of fuel supplied to the engine.

The air-compressor is driven by an eccentric keyed on the crankshaft between the two halves of the after main bearing, while a centrifugal water-pump is driven by a friction wheel from the flywheel and there is a plunger water-pump driven at half engine speed by the camshaft. Piping for these pumps is arranged so that either pump can be used as a circulating-pump while the other can be used as a bilge-pump or auxiliary engine-pump. Each cylinder is equipped with an air-starting valve operated by the camshaft and is automatically shifted in and out by the air-pressure itself. A reverse-gear of the balanced planetary type is extremely rugged, being built by the Western Machinery Co. for their engine.

New German Diesel-powered auxiliary "Carl Vinnen." She was built and engined by Krupps

New passenger-boat "Jeannette Scott" ready for launching. She has just been completed for the Adams Boat Line. Plans and description were published in our November, 1922, issue, on page 851. Two 100 b.h.p. Kahlenberg oil-engines are fitted

Utilization of Waste Exhaust-Gases

Method of Economically Heating Heavy Fuel-Oil Developed by Row & Davis

WASTE heat from Diesel engines is receiving considerable attention at this time. It is carried away from the engine in two separately distinct methods; one, through the means of circulating water, the other, the exhaust gases. In marine practice it is necessary to circulate that quantity of cooling water or jacket water which will keep its outlet temperature below the point where the scale-forming ingredients in the water start to deposit. This temperature is well known by those who have used steam surface condensers and appreciate its importance when using sea-water in a Diesel-engine jacket. Its temperature is around 110° and less. This temperature is very low when we begin to think of using the water for the transmission of the waste-heat to do duty elsewhere. In some instances it would be absolutely impossible or impracticable, from an economy standpoint, to use the cooling water.

The other source of available heat is contained within the exhaust gases. These gases are at temperatures not less than 400° and with such a temperature as a basis to work on, makes it practical and economical to utilize the heat contained in the gases. It is not possible to use all of the heat available, as it would be necessary to cool the gases to a temperature beyond which economy would not exist. The designer who is to prepare the design of a heat absorber must know the uses to which the heat is to be put, in order that he can properly proportion the parts that go to make up this absorber.

Some of these uses are the heating of crew's quarters, the furnishing of steam for the operation of evaporating and distilling plants, supplying of steam to the galley and other necessities or conveniences as they present themselves.

The heat absorber may be constructed along the lines of a water-tube boiler or fire-tube boiler. Row & Davis Engineers, Inc., of 90 West Street, New York, have specialized on this exhaust-gas steam generator, and they find the fire-tube type construction to be the more satisfactory. It must be borne in mind that the heat absorber must be constructed so as to be gas tight, as it is well-known that the exhaust line from the engine to its discharge point in the atmosphere must be tight; otherwise, the escape of gases into the vessel will cause serious trouble.

Row & Davis Engineers also claim that the fire-tube type construction eliminates doubtful points that govern the proportioning of the heating surface that would be found in other forms of construction. An exhaust-gas steam generator, properly proportioned, does not add any material resistance to the discharge of the exhaust gases, but must assist in the reduction of frictional resistance, due to the contracting of the volume of gases by the reduction in temperature.

The operation of one of these generators is very much simplified, due to the fact that there is practically a constant quantity rate of flow of heat from the engine, since the engine in marine service runs at constant speed, developing the constant power. This makes it possible to maintain manually a constant steam pressure in the generator in accordance with the demands for the steam through the setting of a bypass valve placed in the exhaust line. The same adjustment can readily be obtained through a regulating valve.

An interesting step in the path of economy has been brought about by the adaption of the RanD System for reliquidizing fuel-oil in bottom and deep tanks, utilizing steam obtained from the exhaust gas steam generator. There are at the present writing, three motorships having the system installed.

As illustrated by the accompanying cycle diagram, an exhaust-gas steam generator is interposed in the exhaust pipe with dampers and bypass controlling the amount of exhaust-gas passing through the steam generator, which is similar to a fire-tube boiler and so designed that the increased back pressure of the exhaust-gas is negligible, and in which is generated sufficient steam at not over 35 pounds per square inch pressure to meet the requirements of the installation.

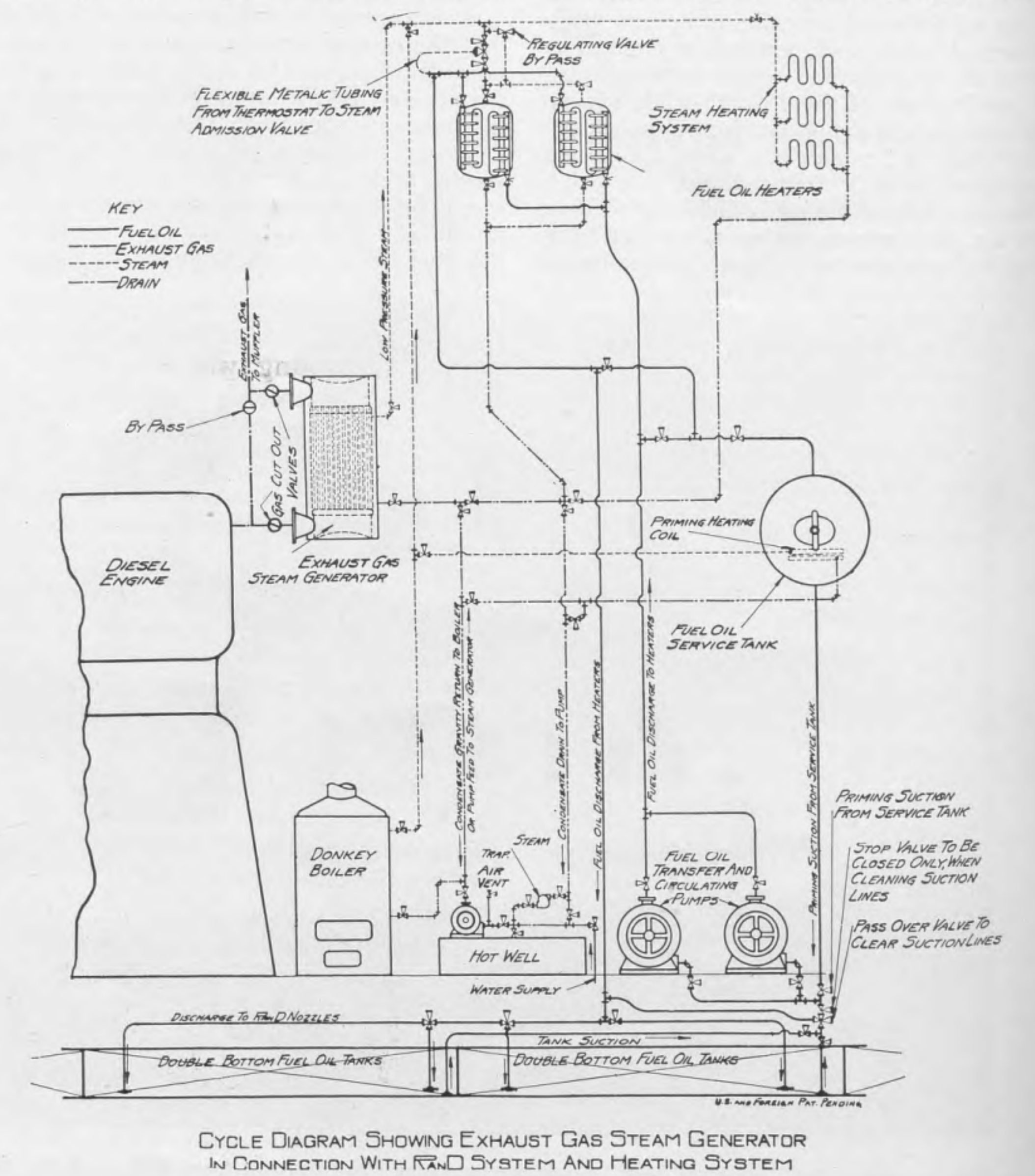
This feature of the adaptation of the system to suit motorship conditions is based on the extensive experience of this company in the design and manufacture of exhaust-gas steam generators installed on submarines, in which case the steam is used for the operation of fresh-water distilling plants.

The steam produced by the exhaust-gas generator supplies the two R&D Paracoil fuel-oil heaters operating in parallel, in which the oil is heated to a predetermined temperature being thermostatically controlled,—and also furnishes steam for the heating system of the ship's quarters.

Fundamentally, the operation except generating the steam, is the same as on steamships, of which over 50 installations have been made or are being made, and which have proven very satisfactory, eliminating the serious and expensive troubles ever present with the old method of steam grids and coils in the tanks; also permitting heating of the oil under known conditions rather than the haphazard former method where it was impossible to know what destructive distillation was occurring immediately surrounding the steam grids.

In the service tank there is installed a special double-spiral steam coil with steam and drain connections external, serving as a priming element, furnishing heated oil to the fuel-oil transfer circulating-pump and heaters for starting the system; steam being used from the donkey-boiler or heating boiler, which is used for port service or when the Diesel engine is not in use.

This priming oil from the service tank is discharged by the fuel-oil transfer-circu-



CYCLE DIAGRAM SHOWING EXHAUST GAS STEAM GENERATOR IN CONNECTION WITH RanD SYSTEM AND HEATING SYSTEM

lating pump through the two specially designed fuel-oil heaters, the oil passing through the manifolds and steel coils which have all joints external of the heaters, precluding the possibility of leaking oil into the condensed steam, and first is discharged into the tank-suction main near the pump to free the suction lines of congealed oil.

After this operation, the heated oil is discharged through the line supplying the revolving nozzle near the point of suction, and is continued only long enough to break through the congealed oil between the nozzle and the tank suction. The use of the service-tank priming suction is then discontinued and the bottom-tank suction opened, and the oil circulated in the bottom tank, passing through the heaters, absorbing B. T. U.'s which are given up to the oil in the bottom tank.

After the suction end of tank is reliquified the heated oil is then directed through the revolving nozzle at the opposite end of the tank and circulation of the tank continued until the temperature of the oil being drawn from the tank indicates that the viscosity of the entire contents of the tank has been lowered, rendering the oil mobile for transferring to the service tanks. The number and location of the nozzles, which revolve, due to the reactionary force of the oil being emitted is given special consideration in each installation to obtain the desired results.

The condensate from oil heaters may be returned direct to the steam generator in a closed system, or to a hot well tank, and returned to the generator by a feed pump. The system is regularly designed and guaranteed to render mobile four times the daily consumption of 12° Baume' Mexican fuel-oil per 24 hours.

Utilizing Exhaust-Gases of Two-Cycle Engines

Some Remarks on the Subject, by Paul Belyavin, Formerly Chief-Engineer, Diesel Dept., Navy Yard at Petrograd

THERE is no other part in a marine oil-engine installation that has been so miscalculated and misjudged as the waste-heat boiler. Several of the early installations were supplied with waste-heat boilers, but they were never fitted in later ones. The impression was given that waste-heat boilers were a failure. Information on this subject available is rather scarce. Judging from such little data as I have been able to obtain, it appears to me that rather more was expected from these boilers than they could give. Although the exhaust gases carry away about 30 per cent. of the total heat of combustion, the amount of heat that can be extracted and used for steam production is very much less, especially in two-cycle engines, where the exhaust gas is diluted with scavenging air and has a much lower temperature. This is apparent from the following rough estimate:

If the exhaust gas of a two-cycle engine is being utilized in a waste-heat boiler for producing steam so that the temperature of the gas leaving the boiler would be $t°$ higher than the temperature of hot water in the boiler, the amount of heat as a percentage of the total carried by the exhaust gas will be roughly:

If T_1 is the absolute temperature of exhaust gas

T_2 the absolute temperature of water or steam

H_1 the percentage of the heat utilized in the boiler of the total carried by exhaust gas

n the efficiency of the boiler

$$H_1 = \frac{T_1 - (T_2 + t)}{T_1}\eta \quad . \quad . \quad (1)$$

If the steam pressure raised in the boiler was about 60 lb. per sq. inch

T_2 would be about 424° C. and

T_1 623° C. assuming the temperature of exhaust gas $t_1 = 350°$ C. for a two-stroke engine

η about 90-95 per cent., and

$$H_1 = \frac{623 - (424 + 10)}{623}\eta = 0.273, \text{ or}$$

about 27.3 per cent.

If the total amount of heat carried by the exhaust gas is $h = 0.30$ of the total heat of burnt fuel, the total amount of heat available for raising steam will be $H = 27.3 \times 0.30 = 8.2$ per cent. The quantity of steam that could be raised in a waste-heat boiler can be roughly calculated in the following manner:

If we call the total amount of heat required to evaporate one kilogram of water of the initial temperature $T°_3$ C. at the pressure of p kilogram per sq. cent. h_1 Cal. per 1 kilogram, which roughly equals

$$h_1 = \lambda - g_0 \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where λ Cal. the total amount of heat required to evaporate 1 kilogram of water of the initial $t° = 0°$ C., and g_0 Cal. is the heat contained in the water of the temperature T_3. If the fuel consumption of the engine per b.h.p. hour is, say, $g = 5$ kilograms, and the calorific value of the fuel, say, $Q = 10,000$ Cal. per kilogram, the total amount of heat developed per b.h.p. hour will be

$$H_2 = g . Q \quad . \quad . \quad . \quad . \quad . \quad (3)$$

The amount of heat which can be used for raising steam is $H_3 = H_2 \times h \times H_1$ or, substituting the value of H_1 and H_2 from the equations 1 and 3.

$$H_3 = \frac{g \times Q \times h \times [T_1 - (T_2 + t)]}{T_1}\eta \text{ Cal} \quad (4)$$

Thus, the amount of steam per b.h.p. per hour equals—

$$W = \frac{g \times Q \times h \times [T_1 - (T_2 + t)]}{h_1 \times T_1}\eta$$

$$= \frac{g \times Q \times h \times [T_1 - (T_2 + t)]}{(\lambda - g_0)T_1}\eta \text{ ks.} \quad (5)$$

The diagram gives the curves for W for various T_1, T_2 and p, assuming $h = 0.30$, $g = 0.195$ kilogram per hour, $g_0 = 15$ Cal., $t = 50°$ C. and $\eta = 0.90$, which are, of course, very conservative figures. The boiler efficiency here represents really only radiation and some possible small losses, as all the other factors affecting the steam production in the waste-heat boiler are already taken into account. From the curves it is apparent that a lower pressure in the boiler is advantageous, and the higher temperature of the exhaust gas is essential. Thus the four-cycle engine is more suitable for working with a waste-heat boiler than a two-cycle one, which has lower temperature of the exhaust gases.

In the example of an engine of about 2,500 h.p. the total amount of steam at 60 lbs. per sq. inch pressure per hour with $g_0 = 50$, $T_1 = 350$, and $t = 10$ would be about $W = 1{,}500$ lbs. Of course, this is not sufficient for driving all the auxiliaries or any similar use, but for heating, cooking, some smaller pumps, dynamo, etc., this amount of steam always required on board ship may prove very useful. As a waste-heat boiler cannot cost very much and at the same time can always be adapted to act as a silencer, which is indispensable, I see no reason why we should not return to waste-heat boilers in certain cases where steam in quantities as mentioned above is required.

In some cases an additional oil-burner in the boiler is recommended in order to assist the steam production in case of necessity. In the waste-heat boiler, as suggested above, the exhaust gas has still a fairly high temperature when leaving the boiler and could be again utilized for raising steam in a low-pressure boiler; this steam could be used for heating purposes and the high-pressure steam from the first boiler for driving some of the auxiliaries. The total quantity of steam available in this case would be nearly double. However, I leave this question of whether this additional complication is desirable, open to discussion.

The discussion on waste exhaust-gases utilization on this page is part of an interesting and detailed paper on the lay-out of the engine-room machinery of a single-acting two-cycle Diesel-driven motorship according to the ideas of P. Belyavin, and read by him before the North East Coast Institution of Engineers & Shipbuilders on Feb. 2nd, 1923.

Unfortunately Mr. Belyavin robs his treatise of some of its value by saying at the outset that there appears to be no sound reason why shipowners should adopt the "much heavier, larger and more expensive four-cycle engine in preference to the much lighter, smaller and cheaper two-cycle one."

Reference to the table of engine-weights published elsewhere in this issue by the same institution will show that this is hardly a correct representation of the facts. Whether two or four cycle type everything depends upon the design!

Seven Designs of Oil-Engines and One Hull

Unique Comparison Competition Inaugurated by British Shipbuilders Society

IN order to stimulate discussion on different types of motorship propelling machinery, a novel method has just been tried in Great Britain by the North East Coast Institution of Engineers and Shipbuilders, Bolbec Hall, Newcastle-on-Tyne. Shipbuilders and oil-engine manufacturers were invited to read papers on power plants for a ship of which a uniform specification was issued by the Institution as follows:

Displacement (loaded)	9,220 tons
Deadweight or Carrying-Capacity (est.)	6,570 tons
Length of Engine-room	40′4½″
Length (O. A.)	371′0″
Breadth (M. D.)	50′9″
Depth (M. D.)	28′0″
Draft	23′0″
Speed on 4 hours' trials	10¾ k.

The engine-room length is more than enough to obtain the 32 per cent. deduction from the gross tonnage under the "out-of-date" Board of Trade measurement regulations for tonnage dues. The proposals submitted provide for a steam boiler of sufficient capacity to provide steam for the operation of the following auxiliary machinery. One steam windlass, 9½ in. by 12 in.; nine steam winches, 7 in. by 10 in.; one steam winch, 7 in. by 12 in.; one 18-kilowatt lighting set and steam heating for the accommodation. At sea only the lighting-set and steam heating will probably be required, and the surplus steam should be available for the steam steering-gear—8½ in.—and other engine auxiliaries. An alternative scheme, with electrically-operated auxiliaries, driven by Diesel-electric generators, was submitted. The information embodied in each of the reviews includes the following particulars:

(1) The total brake horse-power of the engines, stating under what conditions it can be maintained.

(2) The brake horse-power overload obtainable above trial conditions.

(3) The mechanical efficiency of the engine, and the method of arriving at the same.

(4). Fuel consumed per brake horse-power when the ship is steaming at the designed speed of 10¾ knots. (a) for main engines only; (b) for all purposes.

(5) The type of fuel assumed and its calorific value; what fuels are recommended for continuous running, and whether the engines would operate satisfactorily on the heavier boiler-oils for a continuous period.

(6) The total weight of the main propelling-engines and auxiliaries in the engine-room.

(7) Cost per ton-mile.

Lack of comparable information in the schemes submitted seems to be due to two causes, the absence of exact information and stipulations in the proposals put forward by the Institution. The replies provided in answer to the request for information regarding the mechanical efficiency seemed to indicate the differing personalities of the contributors, perhaps more than anything else. The values varied between 73 per cent. and 88 per cent. Information was sought by the organizers of the scheme on the method adopted in deducing these values, but what was provided was not always so definite as to make the large differences in the figures clearly understandable.

The variation in fuel consumption for all purposes showed the range as from 7.4 tons to 10.1 tons per day of 24 hours, and the addition over that used by the engines only to meet "all purposes" showed a variation from 2.5 per cent. to 39 per cent. due to some installations having steam auxiliaries and others having electric. The minimum for the total weight of the propelling engines and the auxiliaries in the engine-room was 350 tons for the Werkspoor, while the maximum was 460 tons for the Vickers. These two four-cycle engines showed the highest and lowest weights, the various two-cycle engines having weights in between. But we believe the Vickers weights included gratings, donkey-boiler, etc.

The following important firms participated and submitted data. Sir Wm. Armstrong Whitworth & Co., Newcastle-on-Tyne (Sulzer engine), R. & W. Hawthorn Leslie & Co., Newcastle-on-Tyne (Werkspoor engine), Wm. Doxfords & Sons, Sunderland (Doxford engine), Scotts Shipbuilding & Engineering Co., Glasgow (Still engine), Swan Hunter & Wigham Richardson, Ltd., Walker-on-Tyne (Neptune engine), Vickers, Ltd., Barrow-in-Furness (Vickers engine), and Palmers Shipbuilding & Iron Co., Jarrow-on-Tyne (Cammellaird-Fullagar engine) with the results as per the table:

	Armstrong-Sulzer	*Cammellaird-Fullagar*	*Doxford*	*Neptune*	*Vickers*	*Hawthorn-Werkspoor*	*Scott-Stil*
Maximum Continuous Power (Shaft)	2,000	2,000	2,000	......	......	2,000	1,870
Normal Continuous Power (Shaft)	1,840	1,828	1850	1,840	1,760	1,848	1,725
Overload Power (Shaft)	2,000	2,300	2,270	2,024	......	......	2,327
Total Number Cylinders	4	4	4	4	6	6	4
Engine Speed (Normal)	92 R.P.M.	85 R.P.M.	96 R.P.M.	90 R.P.M.	112 R.P.M.	95 R.P.M.	......
Fuel Consumption of Main Engines (Shaft H.P. hour)	0.386 lb.	0.39 lb.	0.40 lb.	0.43 lb.	0.42 lb.	0.41 lb.	......
Fuel Consumption All Purposes (Shaft H.P. hour)	0.512 lb.	....	......	0.45 lb.	0.43 lb.	0.45 lb.	0.37 lb.
Weight of Complete Propelling Machinery (tons)	405	414	430 & 450	430	460	350	375
Type of auxiliaries	Electric & Steam	Electric	Steam or Electric	Steam or Electric	Steam	Electric	Steam
Cylinder Bore & Stroke	26.77″x47.24″	24″x36″x2	21¼″x24½″x2	26″x52″	28″x45″	27″x50″	25″x45″
Type of Engine	Two-Cycle (Single-Acting)	Two-Cycle (Opposed-Piston)	Two-Cycle (Opposed-Piston)	Two-Cycle (Single-Acting)	Four-Cycle (Single-Acting)	Four-Cycle (Single-Acting)	Two-Cycle (Double-Acting)

A Question of Repair Bills

Some Sidelights on This Question for the Consideration of Shipowners

When we talk to American shipowners regarding their reasons for not installing Diesel-engines in their ships they often "come back at us" with the statement that they are afraid of the repair bill they will entail as well as refer to the higher first cost. While these owners are probably sincere in this belief, they do not always see or realize the situation as it really is. For twelve years the first ocean-going motorship ever built, the 8-knot VULCANUS, has been in constant service, having covered over 300,000 miles and her repairs and renewals have been insignificant, taking into consideration that she was but an experiment. The American motorship KENNECOTT has covered over 100,000 miles to date and has had no outside engine repair bill as yet. In fact, we could quote hundreds of cases. Engineers of motorships who formerly served on steamships are united in their preference of oil-engine power on the score of absence of repair and excessive overhauling.

In view of this, the following "clipping" may throw a little light on this subject of repairs, stating as it does that an average per steamship for condenser-tubes *alone* will amount to $20,000. Yet these ships have not seen five years' service. Surely, American shipowners should look carefully into this matter of repairs on steamships and motorships before deciding off-hand that the motorship entails a big repair bill.

"Washington, D. C., Jan. 26.—Considerable repair work will be undertaken shortly on the '502' and '535' passenger liners, following the authorization extended by the board to the Division of Maintenance & Repairs to spend $3,000,000 for this purpose. Most of the money will be spent on the 535-foot ships, practically all of which need new condenser-tubes and general overhauling of their engines. It is estimated that the condenser tubes alone will average $20,000 for each vessel. New auxiliary pumps will be provided also. In addition the liners will be supplied with numerous extra parts which they have never had before. Ever since being commissioned, some of the '535s' have given considerable trouble and expense on account of 'boiler-room' mishaps."

A motorship has no boilers, except in some cases where donkey-boilers are fitted; and efficient engineers (of whom there are sufficient available) and proper attention insure that the Diesel-engine and auxiliaries will almost outlive the hull. We have yet to hear of this occurring in the case of a boiler or condenser. Extremely rarely do motorships incur such troubles as the big turbine liners with reduction-gears have experienced of late.

FINE RECORD OF M. S. "NARRAGANSETT"

Up to the end of January last the Vickers-built and oil-engined tanker NARRAGANSETT, 10,050 tons d.w., had covered over 132,000 nautical miles, having made sixteen transatlantic trips, carrying bulk-oil one way and ballast the other, or the most severe tests any vessel can have. On her last passage the weather was so heavy that she was hove-to for 14 hours. Nevertheless, she averaged 9.9 knots on less than 10 tons of oil per day for her main engines. Her auxiliary boilers consumed over 2¾ tons of oil daily in addition. Two 17-ton settling-tanks and a filler system eliminate most of the water from the fuel. Her exhaust-valves have been run for 15 months without refacing.

Our Readers' Opinion

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed)

WOODEN MOTORSHIP MAKES FINE RECORD

To the Editor of MOTORSHIP:

I left Seattle over a year ago as First Asst. Engr. of the DONNA LANE and due to the chief leaving us in China about six months ago, I am now chief. As you no doubt know this little ship is powered with a pair of 500 b.h.p. McIntosh & Seymour Diesel-type marine engines, with Fairbanks-Morse surface-ignition engines for auxiliaries. We have made a splendid showing as far as economy is concerned, having spent only about $10 for actual repairs to the main or auxiliary engines, during the entire year. This was for brazing two joints in one of our high-pressure air lines. Our average daily lubricating-oil consumption at sea for all purposes is a trifle less than 8 gallons. Our daily fuel-consumption at sea averages 32½ barrels. Total time lost through stops at sea during this year is three hours and 48 minutes. During the last twelve thousand miles we had one stop on the port engine of 15 minutes duration.

On the trip from Manila, P. I., to San Francisco, 6,535 miles, it took us, due to bad weather, the greater part of the voyage, thirty-five days, six hours, and twenty-three minutes. The engines were not stopped at any time. We were using as fuel an oil of 17 degrees Baumé at 85 degrees temperature. During this run, we changed four exhaust-valves without stopping the engines.

The main auxiliary engine had to be stopped only once for a minor trouble. Although this run is perhaps no record breaker, I believe it compares favorably with any other and shows what can be done with good engines and when they are properly taken care of how reliable and economical they are.

A. O. HIRSCH,

Chief Engineer,
Motorship DONNA LANE, Seattle, Wash.

BRITISH MOTORSHIP OWNERS ALSO READ THIS MAGAZINE

To the Editor of MOTORSHIP:

You will no doubt be interested in knowing that our London office advise that your periodical is being delivered regularly and they are pleased to receive it. We trust that you have not discontinued this subscription through any misunderstanding.

FURNESS, WITHY & CO., LTD.
Per J. E. Rogers.
Steamship Owners and Agents
Furness House, New York.

UTILIZATION OF EXHAUST GASES

To the Editor of MOTORSHIP:

I was greatly interested in the article by Mr. Chaloner in the January issue of MOTORSHIP, which should prove a very valuable contribution to those of us who are endeavoring to turn these heat losses to good account.

In the remarks enclosed in the "frame" at the head of Mr. Chaloner's article I notice a reference to the successful use of exhaust-heat to obtain power by steam for driving engines, etc., in Dutch and British vessels since 1912. If, as I presume, this refers to a Dutch vessel built by my father in 1912-13 which has proved a practical success then and since, I am afraid this has been somewhat wrongly interpreted. In this vessel there is no steam and only air is used for the steering gear, anchor winch, etc. We took a quantity of air from the lower stage of the main compressor and passed it through a heating coil in the exhaust, thereby heating and expanding it, thus materially increasing its capacity for doing work. This was then used for the steering engine. By arranging for late cut-offs in the working cylinders no trouble from exhaust occurred. It greatly simplified matters as no boiler-water and fuel and attendance, condenser and exhaust steam connection to condenser from the deck gear were required.

The losses due to the main compressor working inefficiently at sea by wire drawing the air at low-pressure suction all the time, or blowing-off air at the first stage, is also avoided because the surplus low stage air is passed through an exhaust heater and used for the steering-engine or available for other small duties.

Incidentally, this might prove a useful method for capstan drive on other trawlers, eliminating the boiler. Notwithstanding the fact that air as compared with water was not as good an agent to take up heat it proved quite practical and an exceedingly simple method. It was a success.

The vessel in which we fitted this was a 1,500 shaft h.p. twin-screw 15 knot gunboat which ran consistently all through the war, no trouble ever occurring with its air power, the simplicity of which was greatly appreciated by the engineers of the vessel.

WM. HAMILTON MARTIN.

Empire Works, Vauxhall, London, Eng.

[We were not referring to the gunboat in question, but to the Anglo-Saxon Petroleum Company's tankers ARES, HERMES, SELENE, ARTEMIS, EMANUEL NOBEL, ELBRUZ, etc. Also, it is our recollection that exhaust-gases were used in some vessels built for Swan, Hunter & Wigham Richardson, Ltd., of England.—EDITOR.]

MOTORSHIP CONSTRUCTION IN GERMANY

(Translated)

To the Editor of MOTORSHIP:

We delivered during the year 1922 the following new Diesel-driven motorships—

Motor-tanker JULIUS SCHINDLER for the ship-owner Julius Schindler, Hamburg, single-screw 3,700 tons d.w., 1,550 i.h.p., 125 revolutions, speed 9¾ knots.

Motor-tanker OSSAG for the ship-owners Stern Sonneborn, Hamburg, 3,700 tons d.w., single screw, 1,550 i.h.p., 125 revolutions, speed 9¾ knots.

Twin-screw motorship ISIS for the Kosmos-Line, Hamburg, 7,400 tons d.w., two 1,550 i.h.p. engines (3,100 i.h.p.), 125 revolutions, speed 12 knots.

Twin-screw motorship OSIRIS for the Kosmos-Line, Hamburg, 7,400 tons d.w., two 1,550 i.h.p. engines (3,100 i.h.p.), 125 revolutions, speed 12 knots.

Twin-screw motorship SPREEWALD for the Hamburg-American-Line, Hamburg, 8,800 tons d.w., two 1,550 i.h.p. engines (3,100 i.h.p.), 125 revolutions, 11 knots.

Twin-screw motorship TIRADENTES for the ship-owners Wilh. Wilhelmsen, Christiania, 8,800 tons d.w., two 1,550 i.h.p. engines (3,100 i.h.p.), 125 revolutions, 11 knots.

In addition we are building for German and northern firms eleven motorships, of a carrying-capacity of 117,800 tons d.w. in total, and an engine capacity of 39,700 i.h.p. in total. All motorships delivered by us, and those we are now building, are equipped with Burmeister & Wain type motors.

DEUTSCHE WERFT.

Hamburg, Germany, January 10, 1923.

[Here are 17 large motorships in two years by one firm, while American shipyards are almost depleted of orders. Its significance can only mean one thing. American ship-owners please note.—EDITOR.]

OIL ENGINE POWER VERSUS STEAM

To the Editor of MOTORSHIP:

I am an engineer of motorships, but have been going-out as an oiler on steamers for the past nine months, and don't like a steamer at all.

Well, I was on one of the well-known Lake-type steam ships of 1,012 net tons. One day I was figuring-out the difference between her and a motorship of the same size, so made a copy of the log for the 24 hours' run, during the finest of weather and with a fair wind. The wind was what you would call smooth down in the waters of the West Indies. The ship was light at the time.

FROM 12 MIDNIGHT TO 12 MIDNIGHT

Watch.	Fuel Gals.	R.P.M.	Eng. Temp.	Running Time.
12-4	940	83.7	108	
4-8	950	84.1	105	
8-12	1,020	84-4	106	260 minutes
12-4	950	82.5	106	
4-8	900	83.0	106	
8-12	980	83.3	104	
	5.740 (19¾ tons).			

Boiler pressures for 4 watches 180, and two watches 185 lbs. p. sq. in., steam on deck for cleaning out holds 11.40 to 5.00, 6.10 to 7.30. Injector on Starboard Boiler 7 minutes. Sea Temp. 80.

The 260 minutes running time was the clock set back at noon to make the right time as we were going west, and the first time to be adjusted after leaving port.

FROM A MOTOR ENGINEER.

Galveston, Texas.

LUBRICATION PROBLEMS

To the Editor of MOTORSHIP:

In your October number I find on page 784 a paragraph by Mr. Arroba Garaycoa, in which this gentleman points out that in all crude-oil motors he is acquainted with, there has been trouble with the gudgeon-pin lubrication. I therefore wish to point out that the Kromhout Engine Works, of Amsterdam, have now found a new system of gudgeon-pin construction, the principle of which is to alter the sliding friction into rolling friction and this rolling is done by a hardened steel gudgeon-pin on a hardened steel plate.

The first engine on which this construction was fitted has now been running for 4,500 hours in a very strenuous service in a North Sea fishing-boat and has given entire satisfaction. This construction eliminates oiling of the gudgeon-pin, so that, besides the impossibility of a hot gudgeon-pin, a saving in lubricating-oil is obtained.

D. GOEDKOOP, JR.,

Managing-Director, Kromhout Engine Works, Amsterdam, Holland.

Danish-Built Motor Yacht for America

Burmeister & Wain of Copenhagen Building 600 H.P. Diesel-Auxiliary Craft for Edward F. Hutton of New York, from Designs by Cox & Stevens

NOW under construction by Burmeister and Wain of Copenhagen, Denmark is a large seagoing steel auxiliary Diesel-yacht for Edward F. Hutton, member of the New York Yacht Club. She is from designs by and under the supervision of Cox & Stevens of New York. Although we were advised of the placing of this important contract a few months ago we have, in deference to Mr. Hutton's wishes, previously refrained from mentioning the order in our pages. However, we are now enabled to describe this new addition to America's fleet of large yachts in which the Diesel-engine is becoming such a prominent factor. It should be noted that a yacht of the dimensions and character of this new three-masted auxiliary being built for Mr. Hutton would likely have been powered with steam-boiler and engine if built ten years ago, while a gasoline engine would probably have been installed five years ago. Today it is significant that Mr. Hutton should have specified in his outline of requirements (which formed the basis upon which Cox & Stevens worked) that she should be equipped with a Diesel-engine of sufficient capacity to drive her when fully loaded and in smooth water at a rate of 11½ knots. With Mr. Hutton's requirements in mind, the designers planned a heavily-constructed, full-bodied seagoing vessel, which is being built to the highest classification of Lloyd's, with the following dimensions:

Length on deck, 196'-7"
Length, water line ....164'-0"
Breadth, md. .... 33'-0"
Draft, mean ... 14'-0"
Auxiliary engine 600 h.p.
Make of engine...Burmeister & Wain Diesel
Speed under power ....11½ knots
Cruising radius 9,000 mi.

It was considered highly desirable in order that the vessel might not be kept out of certain ports which the owner wished to visit, that the draft should not be excessive, and on the dimensions selected by the designers and an inspection of the lines, it seems that, although sufficient draft has been given to enable the vessel to hang on well when going to windward and to otherwise be handy under sail as well as power, the minimum of draft consistent with good seagoing and sailing qualities has been selected.

The auxiliary propelling machinery which is located forward of the mainmast, consists of one Burmeister & Wain six-cylinder 600 h.p. Diesel-engine, with all the necessary auxiliaries and fittings to make a complete and absolutely dependable installation. This engine will drive a two-bladed reversible feathering-type bronze propeller so designed that when the vessel is under sail the blades may be turned in such a way as to offer no interference to sailing, and at the same time completely fill the propeller aperture. The equipment of auxiliary machinery is unusually complete, including two 33 k.w. Diesel-driven dynamos, a very complete equipment of pumps of all types, an electrical installation of the best type, including Edison storage batteries of unusually large capacity, electric boat-hoists, and equipment for handling sails by power, electric-windlass, ice-machine of large capacity with storage boxes of unusual size, and in fact every possible useful equipment for a vessel of the type in question.

The appearance of the new schooner, as shown in the accompanying illustration, will be extremely pleasing, the forward and after overhangs being reasonably short, the freeboard ample and associated with a lively sheer, the designers having selected the clipper-type of stem after careful consideration. The rig is that of a three-masted schooner, having a yard on the foremast for long runs with favorable wind, particular attention having been paid to stepping the masts so that none of the lower sails would have so much canvas as to require a large crew. This has resulted in the use of four head-sails, a rather unusual feature, but a desirable one for the reason already stated. This arrangement will, together with the general disposition of canvas, make it a simple matter to reduce sail promptly to meet any emergency and have the vessel under easy control at all times. While this schooner cannot be said to carry a large sail-plan, she is in no sense under-rigged, the height of the topmasts, however, not being too great to permit passing under the span of the Brooklyn Bridge, which is the limiting factor for operation in and around New York.

E. F. Hutton's Diesel auxiliary-schooner building by Burmeister & Wain from Cox & Stevens' design

The quarters are heated throughout by steam radiators, the plumbing is of the most modern type operated on the pressure system and providing hot and cold running water both fresh and salt. The quarters are all laid out with extreme care to provide comfortable space for owner, guests and crew, and especial attention has been paid to the matter of ventilation, every important space having direct overhead ventilation through skylights, as well as large and properly distributed air-ports.

The arrangement of the interior of the vessel is rather novel and shows not only a very intelligent knowledge on the part of the owner of the requirements for comfort at sea, but a very careful development of his ideas by the designers into a most attractive accommodation plan.

Having in mind the owner's intention to make extended voyages at sea, several features were decided upon, having this particular point in mind, among these being a raised poop deck so that the owner and his guests would always, even in heavy weather, have dry deck-space at their disposal, the building of two teak houses, one aft of the mainmast and one aft of the foremast, and the construction of a navigating bridge just forward of the foremast. All these items detract in no way from the appearance or handiness of the schooner and add materially to her comfort and usefulness when at sea. In every respect the construction and equipment of this vessel will be not only in accordance with the most strict requirements of Lloyd's Register of Shipping, but will be typical of the best practice in yacht construction, no expense having been spared in any direction where either seaworthiness, strength, comfort, or attractive appearance is concerned.

The deck is of teak, as are also the two deck houses, skylights, and all other deck joinerwork. The sails will be of the best quality special yacht duck; the blocks and running, as well as standing-rigging, will be of the best quality obtainable. The outfit of small boats consists of a 28 ft. owner's launch with coupe body, extremely seaworthy in design; an able and burdensome crew's launch 26 ft. in length; two 22 ft. life boats with complete equipment; and in addition, a small 16 ft. launch to be used for marketing and as a general-utility boat.

A brief description of the below-deck accommodations will afford a general idea of the comfort and convenience to be found on this new yacht. There are four steel transverse-bulkheads, namely, the fore and after peak bulkhead, a bulkhead slightly aft of the mainmast separating the owner's and guests' quarters from the accommodations for the officers and crew and machinery

space, and in addition a bulkhead just forward of the foremast; through these two last bulkheads, access is had by means of watertight doors, a necessary feature, making it possible to pass from one end of the ship to the other below deck.

The after deckhouse already referred to extends from the mainmast to the break at the beginning of the poop deck, and has at its after end shelter wings extending aft of the house itself and forming a protected enclosure for the owner and guests when at sea in heavy weather. This deckhouse is used as the main means of access to the owner's and guests' quarters and to the poop, and being of considerable size, forms a very attractive living-room on deck, furnished in addition to lounging chairs, with a large sofa, fireplace, piano, and a very commodious closet or stowage space for coats, deck rugs, and other similar articles. This house not only provides a very comfortable living-room on deck, but makes it possible for the owner and guests in heavy weather to get up and down to their quarters below without difficulty or exposure to the elements, and also acts as a shelter to those sitting on the poop deck.

The main companionway leads from the port side of this living-room directly below to a fore-and-aft passageway or hall at the forward end of which is the dining-room, which is extremely well proportioned and of large size. In determining the dimensions of this room, it was decided that it would not be advisable to extend it the full width of the vessel, as on account of her extreme beam, it would be difficult, if this were done, to secure an attractive appearance or a room of useful shape.

At the extreme after end of this passageway or hall are placed the owner's private apartments, arranged as follows: On the port side is an unusually large stateroom, having a fireplace, immense wardrobes, writing desk, lockers for stowage of miscellaneous items, as well as bed, nightstand and chairs, this room being connected with a large bathroom equipped with all the usual plumbing fixtures. On the starboard side opposite this stateroom and communicating with it as well as with the hall is another large but somewhat smaller room for the owner, similarly furnished and equipped, and having also its own separate but smaller bathroom.

On the port side of the passage or hall will be found in addition to the large linen room and pressing room, two double staterooms for guests, each being of generous proportions equipped with twin beds and having separate bathrooms directly connecting with each room. On the starboard side of the passage there are two additional guests' staterooms, each fitted with twin beds, and having separate bathrooms adjoining, these rooms, however, being of slightly smaller dimensions than those on the port side, and in addition there is placed a stateroom for a maid, whose room is adjacent to the owner's accommodations.

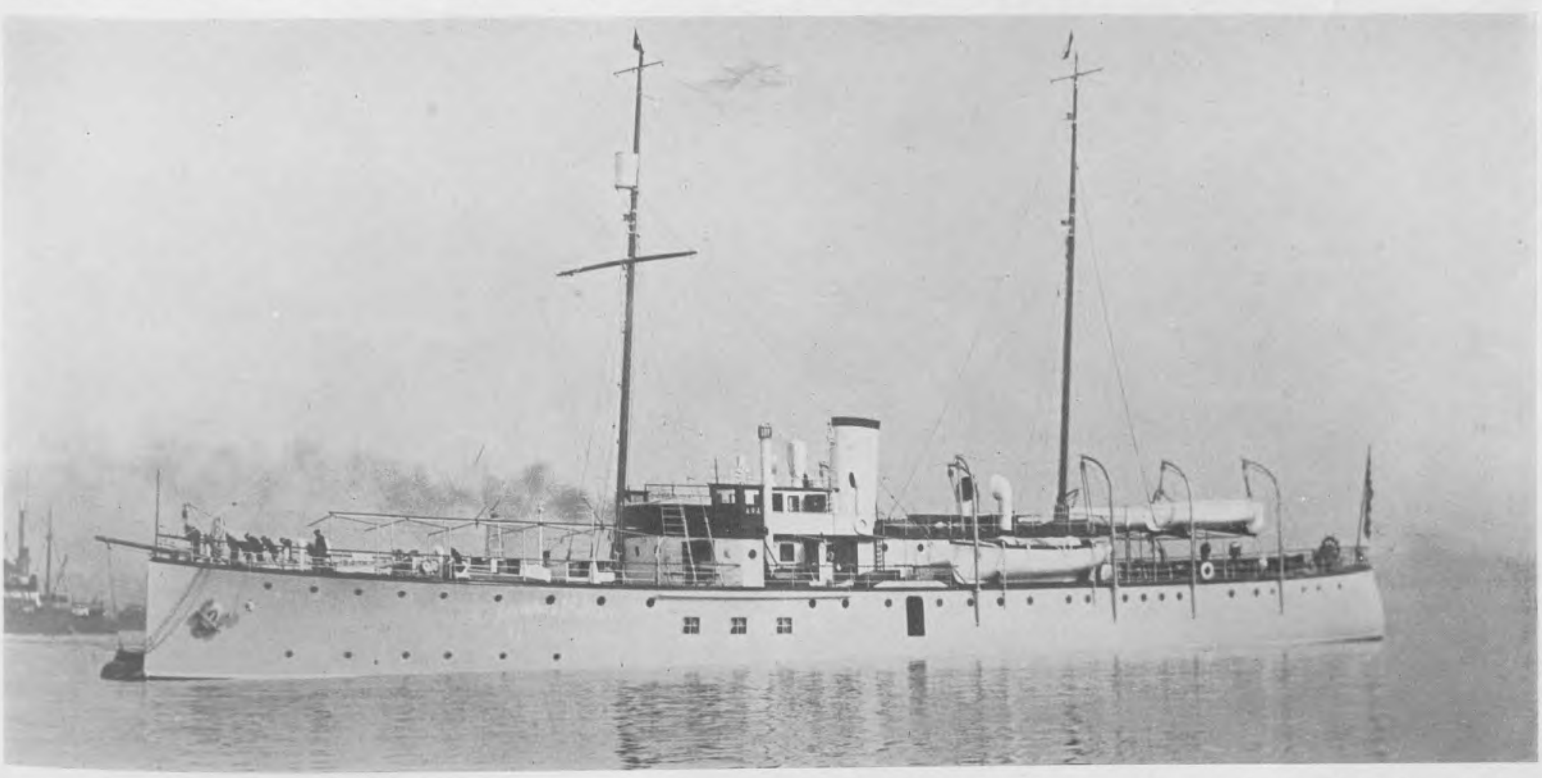
Forward of the dining-room and on each side of the engine-casing are the quarters for the officers, all these rooms being of large size, comfortably arranged, and having connected with them three bathrooms. On the port side forward of the officers' quarters is placed the officers' mess-room, opposite which on the starboard side is a large galley equipped with every modern convenience. A forecastle is arranged to accommodate nineteen men, all sleeping in pipe-berths, with individual lockers for their effects, and there being at the forward end of the forecastle two separate washrooms.

The deckhouse, forward of the mainmast, has at its forward end a chart-room, which can also be used as a deck stateroom for the captain who, however, has a large and comfortable stateroom and office below on the berth deck just forward of the main dining-room. The after end of this deck house is fitted as a radio-room with quarters for the radio operator. The companionways to the officers' quarters have been worked out in an ingenious manner, being placed one on each side at the after end of this deck, the doors opening at the after end, thus making access to this deck easy even in rough weather, these companionways landing one in the starboard and one in the port passage below abreast the machinery enclosure. In addition there are two other companionways forward, one just abaft the foremast and the other at the forward end of the forecastle, so that each and every part of the vessel has an easy and direct communication with the upper deck.

In decorating and furnishing the quarters, the usual practice of avoiding undue carving, ornamentation, or the use of hardwood except where specially suitable, is being followed. The treatment of the wall spaces and overhead surfaces of the staterooms will throughout be secured by the use of "Haskelite" applied directly to wooden partition-bulkheads, an attractive paneling arrangement being secured by applying mouldings to these surfaces when so finished, and the various rooms being tinted in different colors and having a certain amount of painted ornamentation to produce a simple but pleasing effect. The only room in which finish other than as described will be used is in the dining-room, where a simple but rich paneling of French walnut will be used both on the walls and overhead.

This scheme of treatment of the living spaces themselves will be accompanied by the selection of furniture and upholstery in keeping with the individual rooms, and the whole effect unquestionably will be that an attractive livable interior will be produced, and that those who are fortunate enough to be able to live on this craft will have at their disposal every possible convenience for their personal comfort and pleasure.

Being intended for extended offshore cruising, unusually large storerooms have been provided for supplies and equipment for the various departments, and the bunkers carry sufficient oil for a cruising radius of 9,000 miles. She will be delivered early next summer and will undoubtedly prove an attractive addition to the yachting fleet about New York. Much equipment and material for this vessel is being purchased in the United States by the builders.



Motor-yacht "Ara," 870 tons, Wm. K. Vanderbilt, owner, powered with two 825 h.p. Atlas-Polar Diesel-engines. She recently crossed the Atlantic Ocean in 15 days.

3,000 HORSE-POWER AT 85 R. P. M.

The New Burmeister & Wain Diesel-Engine for Ocean Co.'s Single-Screw Motorship "Medon"

In our issue of November last, page 858, we gave illustrations of one of the twin 3,000 i.h.p. Burmeister & Wain four-cycle Diesel engines to be installed in the freighter TANTALUS building for the Ocean Steamship Company (Alfred Holt, Ltd.), of Liverpool. These engines have eight cylinders 29.133-in. bore by 45.275-in. stroke and turn at 115 r.p.m.

We are now enabled to give an illustration of a B. & W. engine of the same power and number of cylinders, but of longer stroke and turning at 85 r.p.m., and which is to be installed in the single-screw freighter MEDON, also to the order of the Ocean Steamship Co.

The twin-screw ship will have four 150 b.h.p. at 300 r.p.m. Diesel-electric generating-sets as engine-room auxiliary power, while the single-screw vessel will only have three auxiliary sets.

LAUNCH OF MS. "SALLY MAERSK"

During the second week in January the new single-screw motorship SALLY MAERSK, 5,100 tons d.w., was launched by the Odense Shipbuilding Company's yard at Odense, to the order of A. P. Moller's Svendborg Steamship Company. This is the tenth vessel completed at this new yard. Another vessel will be launched in two months, and will be followed by the laying of a keel for the twelfth ship. Meanwhile American steamship building yards are almost depleted of work.

MOTORSHIP TRAFFIC THROUGH THE PANAMA CANAL IN 1922

The motorschooner LAURA C. HALL, passed through the Panama Canal 38 times during 1922, making 19 transits in each direction. According to the Panama Canal Record, oil-engined motorship traffic through the canal last year was as follows:

Nationality.	Atlantic to Pacific.			Pacific to Atlantic.		
	No. of ships.	Net tonnage.	Tons of cargo.	No. of ships.	Net tonnage.	Tons of cargo.
British	29	39,898	65,823	29	55,250	83,321
United States	15	63,223	63,677	10	40,864	65,883
Danish	8	38,053	32,527	13	65,125	95,667
Norwegian	9	36,910	48,782	9	38,777	61,509
Italian	5	20,367	6,262	3	11,770	19,634
Swedish	8	37,617	44,848	9	41,882	60,334
Dutch	2	15,102	14,661	2	15,102	19,120
German	2	8,050	9,772	......	......	......
French	2	2,145	1,228	1	854	1,087
Spanish	1	2,957	......	1	2,957	6,000
Panaman	......	......	......	2	121	......
Costa Rican	1	45	6	......	......	......
Totals	82	284,367	287,586	79	272,702	412,621

The following table summarizes the traffic by principal lines, omitting the motor-schooner *Laura C. Hall.* It shows the lines making 2 or more transits with motorships:

Line.	Atlantic to Pacific.			Pacific to Atlantic.		
	No. of ships.	Net tonnage.	Cargo tonnage.	No. of ships.	Net tonnage.	Cargo tonnage.
East Asiatic Co.	7	35,887	32,527	11	60,793	89,299
Pacific Steam Navigation Co.	6	29,024	43,083	8	38,692	63,362
Johnson Line	6	27,101	27,673	8	36,760	52,504
Societa Nazionale de Navigazione	5	20,367	6,262	3	11,770	19,634
Peter Olsen	4	19,026	22,846	5	22,912	37,709
American-Hawaiian Line	4	24,080	27,814	3	18,060	27,600
Alaska Steamship Co	4	13,524	16,098	3	10,143	14,352
Royal Mail Steam Packet Co	3	22,785	18,425	2	15,190	19,050
Swedish Transatlantic Steamship Co.	2	10,506	17,175	1	5,122	7,830
Ore Steamship Co.	2	9,658	......	2	9,658	21,200
United States Shipping Board, (Barber Line)	2	12,452	18,185	......	......	......
Holland-American Line	2	15,102	14,661	2	15,102	19,128
Kosmos Line	2	8,050	9,772	......	......	......
Sociedad Commercial de Oriente	1	2,957	......	1	2,957	6,000

The price of Diesel oil at Balboa, Panama Canal, has been reduced to $2.35 per barrel. We recently urged Governor Morrow to lower the cost of fuel-oil to motorships in accordance with prices elsewhere.

NEW MOTOR LINER FOR INDIAN SERVICE

DALGOMA is the name of the new 4,000 shaft h.p. Stephen-Sulzer Diesel-engined passenger motor-liner of the British India Steam Navigation Line.

CONVERSION OF SHIPPING BOARD STEAMERS

Resolution No. 400, Considered and Passed by the U. S. Senate on January 8, 1923

(Introduced by Senator A. Pomerene of Ohio)

RESOLVED, That the United States Shipping Board be, and it is hereby, directed to send to the Senate the following information:

FIRST. How many ships belonging to the United States Shipping Board are now equipped with Diesel engines, and how many of said ships can be thus equipped?

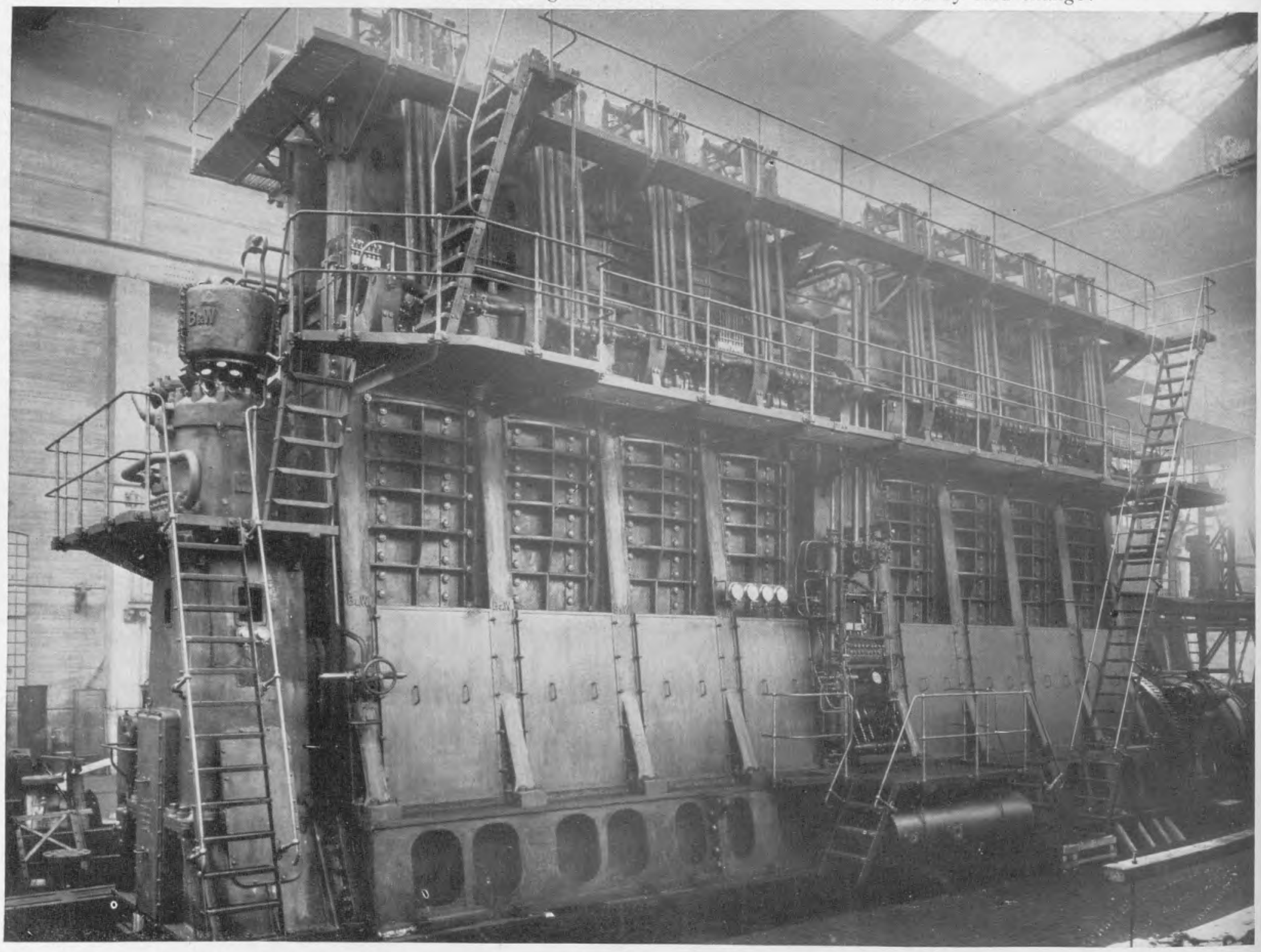
SECOND. Give best estimate as to the reasonable cost of equipping said ships, per ship and as a whole, with the best type of Diesel engine, and the reasonable increase in the value and salability of said ships when thus equipped.

THIRD. Give the best estimate as to the reasonable increase in speed of said ships when thus equipped, and state the number of trips per year between United States Atlantic ports and European ports which can be made by said ships under present equipment and when equipped with Diesel engines.

FOURTH. State the saving in fuel capacity and the cost of fuel in the operation of said ships thus equipped as compared with the fuel capacity, and the cost of coal or oil used as fuel under the present type of equipment.

FIFTH. State what would be the increase in the cargo capacity per ship caused by said change in equipment.

SIXTH. What, if any, saving in crew or wage cost of operation would be occasioned by said change?



The new slow-speed 3,000 i.h.p. Burmeister & Wain marine engine for single screw ships. It turns at 85 r.p.m.